MASSACHUSETTS
Department of Elementary and Secondary Education

Alternate Academic Achievement Standards for the Massachusetts Curriculum Frameworks

(Resource Guide)

SCIENCE and TECHNOLOGY/ENGINEERING

Pre-Kindergarten–Grade 12

Fall 2023

This document was prepared by the
Massachusetts Department of Elementary and Secondary Education

Jeffrey C. Riley
Commissioner

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Introduction and Purpose

The Fall 2023 edition of the *Alternate Academic Achievement Standards for the Massachusetts Curriculum Frameworks in Science and Technology/Engineering* (Resource Guide) incorporates the curriculum content standards in the *2016 Science and Technology/Engineering (STE) Curriculum Framework.* The Resource Guides align achievement of grade-level standards with the requirements of the state's alternate assessment based on alternate academic achievement standards. The Resource Guide is intended to be used for students participating in the alternate assessment.

The Resource Guides are assessment guides for teachers who work with students with the most significant cognitive disabilities who are eligible to participate in the MCAS Alternate Assessment (MCAS-Alt).

The Resource Guide identifies standard-based outcomes called **entry points** for each science practice to assist educators in teaching and assessing appropriately challenging standards-based skills and content that are aligned with grade-level standards, as required by law. Entry points also provide a roadmap for students to make steady progress toward standards at grade-level complexity.

In cases where students are unable to address entry points even at the lowest levels of complexity, due to the severity of their disability, teachers will use access skills that address early developmental communication and motor skills practiced during age-appropriate, standard-based activities. Entry points and access skills are listed for each standard in this Resource Guide.

Resource Guides in English Language Arts (ELA), Mathematics, and Science and Technology/Engineering (STE) are available online at www.doe.mass.edu/mcas/alt/resources.html.

How Resource Guides Were Developed

The Department convened panels of experts in each content area, including content specialists, assessment experts, special educators familiar with students with the most significant cognitive disabilities, higher education faculty, parents and advocates, and members of the state's contractor team (see Acknowledgements on previous page). The panel reviewed the standards, unpacked the information, and identified the essence of the standard. Once panelists agreed upon the essence of the standard, entry points that aligned with specific practices were created based on the standard and placed on a continuum from the least to the most complex. Teachers choose an entry point that assesses a challenging and attainable skill appropriate for each student.

How to Use the Resource Guide

Figure 1 illustrates how to select entry points and access skills for the MCAS-Alt Additional information on how to document student performance and progress throughout the school year can be found in the *Educator's Manual for MCAS-Alt*.

Organization of the Pre-Kindergarten through High School STE Resource Guide

The Resource Guide is organized by discipline:

Grades 5 and 8 STE Disciplines:

- *Earth and Space Science*
- *Life Science*
- *Physical Science (Chemistry and Physics)*
- *Technology/Engineering*

High School STE Disciplines:

- *Biology*
- *Introductory Physics*

Science Practices

The STE curriculum framework incorporates the use of eight **science practices** that promote student engagement in scientific inquiry and engineering design skills. The **entry points and access skills are incorporated within each science practice**.

The eight **science practices** in the 2016 STE Curriculum Framework:

Asking (Scientific) Questions and Defining Problems

Planning and Carrying Out Investigations (to gather data and perform experiments to answer a scientific question)*

Using Mathematical and Computational Thinking (to answer scientific questions)

Analyzing and Interpreting Data (to recognize patterns and analyze and organize data)

Developing and Using Models (to think about and make sense of an experience and make predictions, using 2-D and 3-D representations, constructions, displays, illustrations, and simulations)*

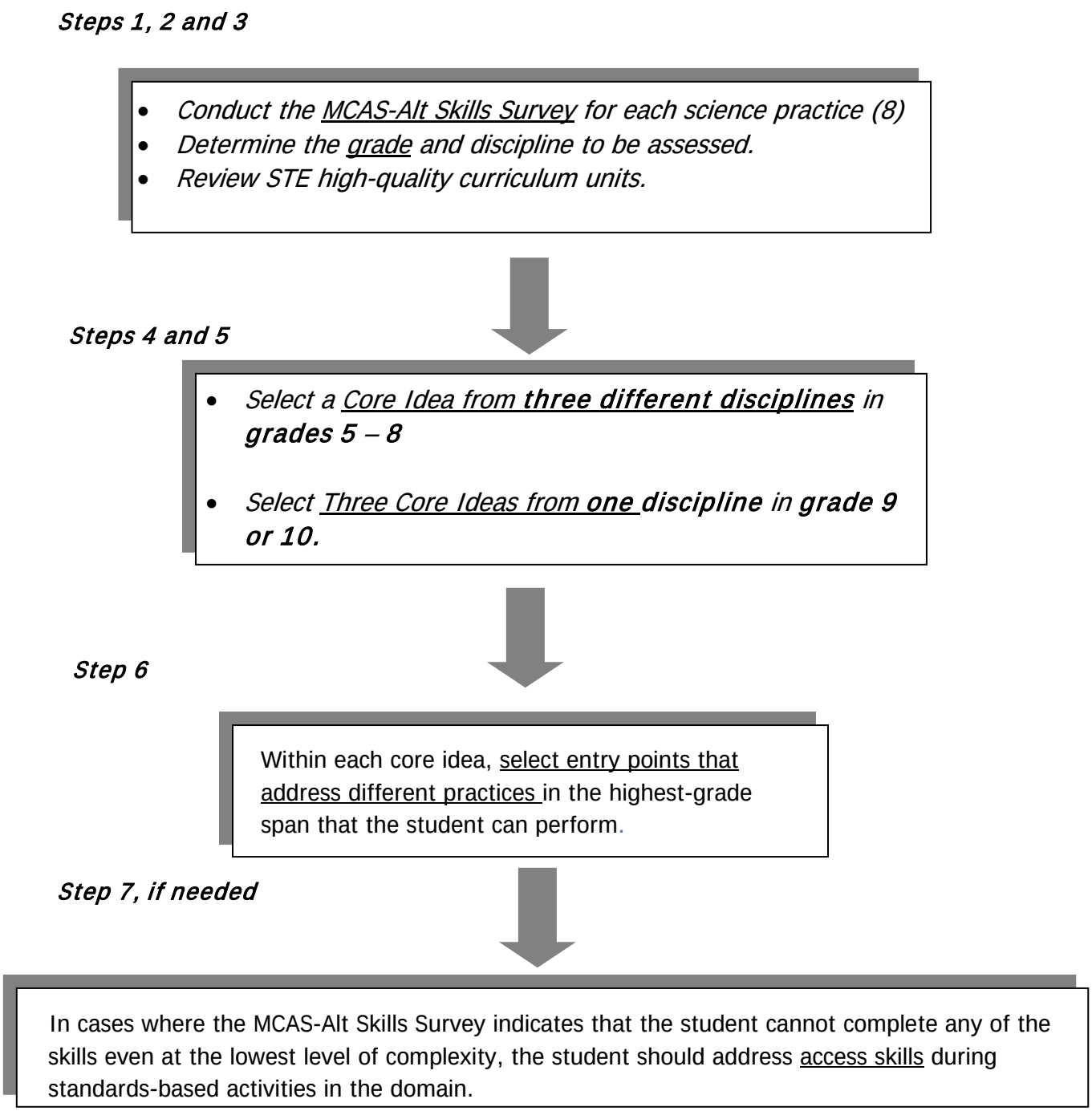
*Constructing Explanations and Designing Solutions (to explain phenomena and use **evidence** to support explanations)*

Engaging in Argument from Evidence (to support a claim and critique competing arguments)

Obtaining, Evaluating, and Communicating Information (to research, record, evaluate, and present information from scientific texts and digital sources

Figure 1

How to Select Entry Points and Access Skills for the MCAS-Alt



Definitions of Terms Used in this Resource Guide

- **Access Skills** are developmental (communication or motor) skills identified as instructional outcomes in the content area being assessed. Access skills should be addressed during standards-based science activities and are listed separately based on the core of each discipline.
- **Core Ideas** are topics that consist of clusters of standards in a related area of a science and technology/engineering discipline, such as Earth's Systems in Earth and Space Science.
- **Disciplines** a particular branch of scientific knowledge, such as Life Science.
- **Entry Points** are academic outcomes below grade-level expectations that are aligned with each grade-level standard and core idea. Entry points are intended for use by educators to instruct students with disabilities who are performing below grade-level expectations.
- **Investigation** is a process by which a variety of methods and tools are used to make observations and measurements that result in the recording of data to answer a scientific phenomenon. For example, the student can engage in exploratory activities in which they identify questions gather information and investigate the question, and produce a response, inference, conclusion, or findings.
- **Model** is a representation or illustration that describes the features of a system, object, process, pattern, or relationship, with varying degrees of detail and accuracy depending on the purpose for which the model is being used. These may include drawings, sketches, diagrams, flow charts, physical constructions in 2- or 3-dimensions, computer simulations, and demonstrations.
- **Science Practices** define a set of skills that promote student engagement in scientific inquiry and engineering design in learning about the content of each discipline. The practices intentionally overlap, interconnect, and integrate with the content contained in the core idea being assessed.
- **Standards** define what all students should understand and be able to do in a content area in each grade span. Each standard in the Resource Guide is listed precisely as it appears in the *2016 Massachusetts Science and Technology/Engineering Curriculum Framework.*

Asterisks (*) designate standards that have an engineering design application.

Science and Technology/Engineering
Pre-K–Grade 8

EARTH AND SPACE SCIENCES

Core Idea	Access Skills	Grades Pre-K–2	Grades 3–5	Grades 6–8
Earth's Place in the Universe	Pages 13–15	Pages 9, 11, 20–21	Pages 27–30	Pages 35, 37, 39–40
Earth's Systems	Pages 15–17	Pages 9–10, 12, 21–23	Pages 26–28, 30–32	Pages 35–37, 41–43
Earth and Human Activity	Pages 17–19	Pages 9–10, 23–25	Pages 26–28, 32–34	Pages 36, 38, 43–45

Grade Level: Pre-Kindergarten

Core Idea	Learning Standards as written	
Earth's Place in the Universe	**PreK-ESS1-1(MA)**	Demonstrate awareness that the Moon can be seen in the daytime and at night, and of the different apparent shapes of the Moon over a month. Clarification Statement: ♦ The names of moon phases or sequencing of moon phases is not expected.
	PreK-ESS1-2(MA)	Observe and use evidence to describe that the Sun is in different places in the sky during the day.
Earth's Systems	**PreK-ESS2-1(MA)**	Raise questions and engage in discussions about how different types of local environments (including water) provide homes for different kinds of living things.
	PreK-ESS2-2(MA)	Observe and classify non-living materials, natural and human made, in the local environment.
	PreK-ESS2-3(MA)	Explore and describe different places water is found in the local environment.
	PreK-ESS2-4(MA)	Use simple instruments to collect and record data on elements of daily weather, including sun or clouds, wind, snow or rain, and higher or lower temperature.
	PreK-ESS2-5(MA)	Describe how local weather changes from day to day and over the seasons and recognize patterns in those changes. ♦ Clarification Statement: ♦ Descriptions of the weather can include sunny, cloudy, rainy, warm, windy, and snowy.
	PreK-ESS2-6(MA)	Provide examples of the impact of weather on living things. Clarification Statement: ♦ Make connections between the weather and what they wear and can do and the weather and the needs of plants and animals for water and shelter.
Earth and Human Activity	**PreK-ESS3-1(MA)**	Engage in discussion and raise questions using examples about local resources (including soil and water) humans use to meet their needs.
	PreK-ESS3-2(MA)	Observe and discuss the impact of people's activities on the local environment.

Grade Level: Kindergarten

Core Idea	Learning Standards as written	
Earth's Systems	**K-ESS2-1**	Use and share quantitative observations of local weather conditions to describe patterns over time. Clarification Statements: ♦ Examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month, and relative temperature. ♦ Quantitative observations should be limited to whole numbers.
	K-ESS2-2	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment. Clarification Statement: ♦ Examples of plants and animals changing their environment could include a squirrel digging holes in the ground and tree roots that break concrete.
Earth and Human Activity	**K-ESS3-2**	Obtain and use information about weather forecasting to prepare for, and respond to, different types of local weather.
	K-ESS3-3	Communicate solutions to reduce the amount of natural resources an individual uses. * Clarification Statement: ♦ Examples of solutions could include reusing paper to reduce the number of trees cut down and recycling cans and bottles to reduce the amount of plastic or metal used.

Asterisks (*) designate standards that have an engineering design application

Grade Level: Grade 1

Core Idea	Learning Standards as written	
Earth's Place in the Universe	**1-ESS1-1**	Use observations of the Sun, Moon, and stars to describe that each appears to rise in one part of the sky, appears to move across the sky, and appears to set.
	1-ESS1-2	Analyze provided data to identify relationships among seasonal patterns of change, including relative sunrise and sunset time changes, seasonal temperature and rainfall or snowfall patterns, and seasonal changes to the environment. Clarification Statement: ♦ Examples of seasonal changes to the environment can include foliage changes, bird migration, and differences in amount of insect activity.

Grade Level: Grade 2

Core Idea	Learning Standards as written	
Earth's Systems	**2-ESS2-1**	Investigate and compare the effectiveness of multiple solutions designed to slow or prevent wind or water from changing the shape of the land.* Clarification Statements: ♦ Solutions to be compared could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land. ♦ Solutions can be generated or provided.
	2-ESS2-2	Map the shapes and types of landforms and bodies of water in an area. Clarification Statements: ♦ Examples of types of landforms can include hills, valleys, river banks, and dunes. ♦ Examples of water bodies can include streams, ponds, bays, and rivers. ♦ Quantitative scaling in models or contour mapping is not expected.
	2-ESS2-3	Use examples obtained from informational sources to explain that water is found in the ocean, rivers and streams, lakes and ponds, and may be solid or liquid.
	2-ESS2-4(MA)	Observe how blowing wind and flowing water can move Earth materials from one place to another and change the shape of a landform. Clarification Statements: ♦ Examples of types of landforms can include hills, valleys, river banks, and dunes.

ACCESS SKILLS to Earth and Space Sciences Standards

CORE IDEA	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe	**1. Asking questions/defining problems** ♦ Explore materials representing the Earth, Moon, Sun, stars, solar system, or seasons visually or tactilely (Specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing the Earth, Moon, Sun, stars, solar system, or seasons within a specified amount of time of the activity being interrupted ♦ Gain attention within a specified time block(s) to explore materials representing the Earth, Moon, Sun, stars, solar system, or seasons ♦ Make a request to explore materials representing the Earth, Moon, Sun, stars, solar system, or seasons within specified blocks of time ♦ Choose within a specified amount of time from an errorless array of materials related to the Earth, Moon, Sun, stars, solar system, or seasons ♦ Match object to object, or picture to picture of materials in an Earth, Moon, Sun, stars, solar system, or seasons activity **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about the Earth, Moon, Sun, stars, solar system, or seasons for a specified amount of time	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials related to an Earth, Moon, Sun, stars, solar system, or seasons activity for a specified amount of time in a comparison activity ♦ Release or give materials related to an Earth, Moon, Sun, stars, solar system, or seasons activity within a specified amount of time in a comparison activity ♦ Turn on/off technology related to an Earth, Moon, Sun, stars, solar system, or seasons activity within a specified amount of time in a comparison activity ♦ Move materials related to an Earth, Moon, Sun, stars, solar system, or seasons activity in a comparison activity ♦ Use two hands to manipulate materials related to an Earth, Moon, Sun, stars, solar system, or seasons activity in a comparison activity ♦ Imitate action related to an Earth, Moon, Sun, stars, solar system, or seasons activity in a comparison activity ♦ Initiate cause and effect response related to an Earth, Moon, Sun, stars, solar system, or seasons activity within a specified time block(s) in a comparison activity	**5. Developing and using models** ♦ Track a model (shift focus from materials to speaker) in an Earth, Moon, Sun, stars, solar system, or seasons activity ♦ Orient or manipulate materials or a model in an Earth, Moon, Sun, stars, solar system, or seasons activity ♦ Functionally use materials or a model related to the Earth, Moon, Sun, stars, solar system, or seasons activity ♦ Locate objects partially hidden or out of sight in an Earth, Moon, Sun, stars, solar system, or seasons activity ♦ Construct or assemble a model to represent the Earth, Moon, Sun, stars, solar system, or seasons ♦ Use one object to act on another in a model representing the Earth, Moon, Sun, stars, solar system, or seasons (e.g., use a pointer to tap a globe) **6. Constructing explanations** ♦ Move materials related to the creation of a written product that describes the characteristics of seasonal changes in the environment ♦ Choose from an array of errorless choices (within a specified amount of time) related to the creation of a written product that describes how the position of the Sun and Earth results in day and night

ACCESS SKILLS to Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe (cont.)	**2. Planning and carrying out investigations** ♦ Release or give materials in an Earth, Moon, Sun, stars, solar system, or seasons investigation within a specified amount of time of the directive ♦ Turn on/off technology in an Earth, Moon, Sun, stars, solar system, or seasons investigation within a specified amount of time ♦ Move materials in an Earth, Moon, Sun, stars, solar system, or seasons investigation ♦ Use two hands in an Earth, Moon, Sun, stars, solar system, or seasons investigation ♦ Imitate action in an Earth, Moon, Sun, stars, solar system, or seasons investigation ♦ Initiate cause and effect response in an Earth, Moon, Sun, stars, solar system, or seasons investigation within a specified time block(s)	**4. Using mathematics and computational thinking** ♦ Track materials in an Earth, Moon, Sun, stars, solar system, or seasons activity in the creation of a table, chart, or graph ♦ Orient or manipulate materials in an Earth, Moon, Sun, stars, solar system, or seasons activity in the creation of a table, chart, or graph ♦ Functionally use materials in an Earth, Moon, Sun, stars, solar system, or seasons activity in the creation of a table, chart, or graph ♦ Locate objects partially hidden or out of sight in an Earth, Moon, Sun, stars, solar system, or seasons activity in the creation of a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph in a model representing Earth, Moon, Sun, stars, solar system, or seasons (e.g., glue stick to adhere materials to graph)	**7. Engaging in argument from evidence** ♦ Activate a device (within a specified amount of time) to create a written product to support an argument/claim about how daylight changes with each season ♦ Choose from an array of errorless choices (within a specified amount of time) related to the creation of a written product to support an argument/claim about how the shape of the moon changes over a month **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing an Earth, Moon, Sun, stars, solar system, or seasons activity ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing an Earth, Moon, Sun, stars, solar system, or seasons activity ♦ Move or functionally use materials to communicate ideas/information representing an Earth, Moon, Sun, stars, solar system, or seasons activity (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing an Earth, Moon, Sun, stars, solar system, or seasons activity

ACCESS SKILLS to Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Match object to object, or object to picture, or picture to picture of materials representing an Earth, Moon, Sun, stars, solar system, or seasons activity
Earth's Systems	**1. Asking questions/defining problems** ♦ Explore materials representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps visually or tactilely (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified amount of time of the activity being interrupted ♦ Gain attention to explore materials representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified time block(s) ♦ Make a request to explore materials representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of materials related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps for a specified amount of time in a comparison activity ♦ Release or give materials related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified amount of time in a comparison activity ♦ Turn on/off technology related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified amount of time in a comparison activity ♦ Move materials related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps in a comparison activity ♦ Use two hands to manipulate materials related to weather patterns, Earth's layers, impact of weather on landforms, water cycle, or topographical maps in a comparison activity ♦ Attend visually or by touch to materials related to weather patterns, Earth's layers, impact of weather on landforms, water cycle, or topographical maps in a comparison activity	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials or models related to weather patterns, impact of weather on landforms, Earth's layers, Earth's layers, water cycle, or topographical maps ♦ Orient or manipulate materials or models related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Functionally use materials or models related to the weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Locate objects partially hidden or out of sight in a model related to weather, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Construct or assemble models representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps

ACCESS SKILLS to Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Match object to object, or picture to picture of materials related to weather patterns, or the impact of weather on landforms, Earth's layers, or the water cycle ♦ Activate technology (i.e. hitting a switch) within a specified amount of time, to generate scientific questions related to weather patterns, impact of weather, Earth's layers, or the water cycle **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps investigation for a specified amount of time ♦ Release or give materials in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified amount of time of the directive ♦ Turn on/off technology in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps investigation within a specified amount of time ♦ Move materials in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps investigation ♦ Use two hands in an investigation on weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps	**3. Analyzing and interpreting data (cont.)** ♦ Imitate action related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps in a comparison activity ♦ Initiate cause and effect response related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified time block(s) in a comparison activity ♦ Activate a device (within a specified amount of time) to group information/data about how weather impacts the clothes people wear **4. Using mathematics and computational thinking** ♦ Track materials in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps activity in the creation of a table, chart, or graph ♦ Orient or manipulate materials in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps activity in the creation of a table, chart, or graph ♦ Functionally use materials in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps activity in the creation of a table, chart, or graph	**5. Developing and using models (cont.)** ♦ Use one object to act on another in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps in a model (e.g., use a pointer to tap a weather map) **6. Constructing explanations** ♦ Activate technology (i.e. hitting a switch) for the creation of a written product within a specified amount of time, to describe appropriate clothing based on weather conditions **7. Engaging in argument from evidence** ♦ Choose within a specified amount of time from an errorless array of materials for the creation of a written product to support an argument/claim that plants and animals can change the environment (e.g., animals dig holes, tree roots break through concrete) **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps

ACCESS SKILLS to Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Imitate action in an investigation on weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Initiate cause and effect response in an investigation on weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified time block(s) ♦ Activate a device (within a specified amount of time) to record observations to collect data about local weather ♦ Attend visually or by touch to record observations to collect data about local weather ♦ Choose from an errorless array, within specified time, in an investigation on weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps within a specified time block(s)	**4. Using mathematics and computational thinking (cont.)** ♦ Locate objects partially hidden or out of sight in a weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps activity in the creation of a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph of a model representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps (e.g., glue stick to adhere materials to graph) ♦ Activate technology (i.e. hitting a switch) for the creation of a table, chart and/or graph (within a specified amount of time) related to weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Attend visually or by touch to images of the seasons and then temperature cards that corresponded to each season (i.e. warm, cool, hot, cold) ♦ Activate a device (within a specified amount of time) to discuss appropriate clothing for the weather when it's hot/cold	**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Move or functionally use materials to communicate ideas/information representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps ♦ Match object to object, or object to picture, or picture to picture of materials representing weather patterns, impact of weather on landforms, Earth's layers, water cycle, or topographical maps

ACCESS SKILLS to Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)	**1. Asking questions/defining problems** ♦ Explore materials representing natural disasters, recycling or global warming visually or ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing natural disasters, recycling or global warming (specify accuracy criteria) ♦ Make a request to explore materials representing natural disasters, recycling or global warming within a specified amount ♦ Choose within a specified amount of time from an errorless array of materials related to natural disasters, recycling or global warming within a specified amount ♦ Match object to object, or picture to picture using materials related to natural disasters, recycling, or global warming ♦ Activate a switch (within a specified amount of time) to generate a list of scientific questions related to natural disasters, recycling, water filtration, or global warming within a specified amount **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in a natural disasters, recycling or global warming investigation for a specified amount of time ♦ Release or give materials in a natural disasters, recycling or global warming within a specified amount of time of the directive	**3. Analyzing and interpreting data** ♦ Release or give materials representing natural disasters, recycling or global warming within a specified amount of time in a comparison activity ♦ Grasp (hold) materials representing natural disasters, recycling or global warming for a specified amount of time in a comparison activity ♦ Turn on/off technology representing natural disasters, recycling or global warming within a specified amount of time in a comparison activity ♦ Move materials representing natural disasters, recycling or global warming in a comparison activity ♦ Use two hands to manipulate materials representing natural disasters, recycling or global warming in a comparison activity ♦ Imitate action representing natural disasters, recycling or global warming in a comparison activity ♦ Initiate cause and effect response representing natural disasters, recycling or global warming within a specified time block(s) in a comparison activity **4. Using mathematics and computational thinking** ♦ Track materials in a natural disasters, recycling or global warming activity in the creation of a table, chart, or graph ♦ Orient or manipulate materials in a natural disasters, recycling or global warming activity in the creation of a table, chart, or graph	**5. Developing and using models** ♦ Track materials or models (shift focus from materials to speaker) in an activity on natural disasters, recycling or global warming ♦ Orient or manipulate materials or models in a natural disasters, recycling or global warming activity ♦ Functionally use materials or models related to a natural disasters, recycling or global warming activity ♦ Locate objects or models partially hidden or out of sight in a natural disasters, recycling or global warming activity ♦ Construct or assemble models related to natural disasters, recycling or global warming ♦ Use one object to act on another in a natural disasters, recycling or global warming model (e.g., use a pointer to tap recycle bin) ♦ Activate switch (within a specified amount of time) to label a model in a natural disasters, recycling, water filtration, or global warming activity ♦ Visually/tactilely attend (specify accuracy criteria) to materials to label a model in a natural disasters, recycling, water filtration, or global warming activity **6. Constructing explanations** ♦ Orient or manipulate materials related to the creation of a written product to describe how weather forecasting helps people plan for specific types of weather (e.g., dressing appropriately, staying home)

ACCESS SKILLS to Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Turn on/off technology in an investigation about natural disasters, recycling or global warming within a specified amount ♦ Move materials in an investigation about natural disasters, recycling or global warming ♦ Use two hands in an investigation about natural disasters, recycling or global warming ♦ Imitate action in an investigation about natural disasters, recycling or global warming ♦ Initiate cause and effect response in an investigation about natural disasters, recycling or global warming, within a specified time block(s) ♦ Attend visually/tactilely (specify accuracy criteria) to materials in a natural disasters, recycling, water filtration, or global warming investigation for a specified amount of time ♦ Activate a switch (within a specified amount of time) in a natural disasters, recycling, water filtration, or global warming investigation for a specified amount of time	**4. Using mathematics and computational thinking (cont.)** ♦ Functionally use materials in a natural disasters, recycling or global warming activity in the creation of a table, chart, or graph ♦ Locate objects partially hidden or out of sight in a natural disasters, recycling or global warming activity in the creation of a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph in a model representing natural disasters, recycling or global warming (e.g., glue stick to adhere materials to graph)	**7. Engaging in argument from evidence** ♦ Choose within a specified amount of time, from an errorless array of materials related to the creation of a written product to support an argument/claim for or against a design solution that can prevent damage from natural weather events **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing natural disasters, recycling or global warming ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing natural disasters, recycling or global warming ♦ Move or functionally use materials to communicate ideas/information representing natural disasters, recycling or global warming (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing natural disasters, recycling or global warming ♦ Match object to object, or object to picture, or picture to picture using materials related to natural disasters, recycling, or global warming ♦ Activate switch (within a specified amount of time) to share information about communicate ideas/information representing natural disasters, recycling, water filtration, or global warming

ENTRY POINTS to
Earth and Space Sciences Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe	**1. Asking questions/defining problems** ♦ Record relevant questions about the Sun's position at different times of day based on observations ♦ Record relevant questions about the Moon's shape and position at different times of day based on observations or other media sources ♦ Record relevant questions about the seasonal changes to the environment based on observations or other media sources (e.g., leaves falling from trees, buds blooming) ♦ Record relevant questions about weathering and erosion **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the Sun's position at different times of day ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about Moon's shape and position at different times of day ♦ Record data based on observations related to seasonal changes to the environment (e.g., migrating birds, foliage, temperature)	**3. Analyzing and interpreting data** ♦ Group information/data about seasonal changes to the environment to identify patterns. ♦ Compare predictions to the data and/or observations from an investigation about the movement of the Sun, Moon, and stars across the sky **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the times of sunrise and sunset over a period of time ♦ Identify the qualitative and quantitative information about the apparent position of the Sun at different times of the day ♦ Identify the qualitative and quantitative information about the apparent shape of the Moon on different days during the monthly cycle	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain that the Moon and/or Sun appear to rise in the east, move across the sky, and set in the west ♦ Illustrate, construct, and/or label a model to show/explain seasonal changes to the environment (e.g., leaves fall in autumn, flowers bloom in spring) ♦ Illustrate, construct, and/or label a model to show/explain patterns on or around the Earth that occur each day, week, month, or year (e.g., cycle of the moon, seasons, day and night) ♦ Develop, revise and/or use a model to show/explain the relative age of fossils found in layers of rock **6. Constructing explanations** ♦ Describe how the positional relationship between the Sun and the Earth results in day and night ♦ Describe the changing appearance of the Moon over a month (e.g., phases) ♦ Describe the characteristics of seasonal changes in the environment ♦ Describe how the duration of daylight changes with each season **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how the duration of daylight changes with each season ♦ Use scientific evidence in support of an argument that the shape of the Moon changes over a monthly cycle

ENTRY POINTS to
Earth and Space Sciences Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe (cont.)			**7. Engaging in argument from evidence (cont.)** ♦ Use scientific evidence in support of an argument that the Sun and Moon move across the sky in the same direction over the course of a day **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about the different apparent shapes of the Moon over a month ♦ Recall and present information from observations, text, or media source about seasonal changes to the environment ♦ Recall and present information from observations, text, or media source about the different locations of the Sun in the sky during the day
Earth's Systems	**1. Asking questions/defining problems** ♦ Record relevant questions about seasonal change based on observations ♦ Record relevant questions about how plants and animals can change the environment based on observations (e.g., tree roots that break concrete, beavers building dams) ♦ Record relevant questions about natural and human made materials based on observations ♦ Record relevant questions about where water is found on Earth	**3. Analyzing and interpreting data** ♦ Group information/data about the weather and its effects on plants and animals to identify patterns (e.g., water and shelter) ♦ Group information/data about how the weather impacts the clothes people wear ♦ Compare predictions to the data and/or observations from an investigation about different weather conditions ♦ Compare predictions to the data and/or observations from an investigation about how wind and water can change the shape of the land	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show landforms and bodies of water on a map ♦ Illustrate, construct, and/or label a model to show solutions to prevent wind or water from changing the shape of the land (e.g., planting shrubs or building seawall) ♦ Illustrate, construct, and/or label a model to show where water is found on Earth ♦ Illustrate, construct, and/or label a model to show where on Earth water can be liquid or solid

ENTRY POINTS to
Earth and Space Sciences Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Identify questions that can be answered by an investigation about how local weather changes ♦ Define a simple problem about a change to the land that occurs from the wind and/or water ♦ Record relevant questions about landforms and/or bodies of water based on observations ♦ Distinguish between scientific and non-scientific questions about water in the local environment (e.g. How did the pond get in my yard? Do you like to swim?) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations to collect data about weather using simple instruments (e.g., thermometer, barometer, rain gauge) ♦ Plan and/or follow the steps of an investigation to collect data on how wind and water can change the shape of the land ♦ Record observations (e.g., firsthand experiences, media) to collect data about local weather ♦ Record observations (e.g., firsthand experiences, media) to collect data about natural and human made materials (e.g., rocks vs concrete) ♦ Use pictures and/or drawings to collect observations related to the seasons	**3. Analyzing and interpreting data (cont.)** ♦ Compare predictions to the data and/or observations from an investigation about different design solutions used to prevent wind or water from changing the shape of the land ♦ Display data using a simple graph or pictures to show temperature readings to compare typical seasonal conditions ♦ Display data using a simple graph or pictures to show ♦ temperature reading to compare various forms of precipitation ♦ Display data using a simple graph or pictures to show ♦ natural and human made materials in the environment ♦ Display data using a simple graph or pictures to show ♦ how plants and animals can change the environment **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about daily weather, including precipitation, sunny/cloudy, temperature, and rain/snow ♦ Use counting and numbers to show data about seasonal patterns ♦ Use counting and numbers to show data about natural and man-made materials in the environment ♦ Identify the qualitative and quantitative information about weather's impact on animals and plants	**6. Constructing explanations** ♦ Describe natural locations where water can be found on Earth ♦ Describe appropriate responses to different weather conditions (e.g., it is cold – I need my coat) ♦ Describe characteristics of typical seasonal weather patterns (e.g., winter is snowy, summer is hot) ♦ Describe how seasonal changes impact the environment ♦ Identify observations the match descriptions about natural and human made materials in the environment ♦ Generate a solution to a problem about how wind or water changes the land using pictures or drawings. **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how plants and animals can change the environment (e.g., animals dig holes, tree roots can break concrete) ♦ Use scientific evidence in support of an argument about the effectiveness of a solution to prevent wind or water from changing the shape of the land

ENTRY POINTS to
Earth and Space Sciences Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Use pictures and/or drawings to collect observations related to weather conditions (e.g., sunny, cloudy, rainy, windy) ♦ Use pictures and/or drawings to collect observations about the shapes and types of landforms (e.g., hills, valleys, dunes) and/or bodies of water (e.g., streams, ponds, bays, rivers) ♦ Use pictures and/or drawings to collect observations related to different design solutions used to prevent wind or water from changing the shape of the land	**4. Using mathematics and computational thinking (cont.)** ♦ Identify the qualitative and quantitative information local weather conditions (sunny/cloudy, temperature, and rain/snow)	**8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about how wind and water can change the shape of the land ♦ Recall and present information from observations, text, or media source about natural and human made materials in the environment ♦ Recall and present information from observations, text, or media source about the shapes and types of landforms (e.g., hills, valleys, dunes) and/or bodies of water (e.g., streams, ponds, bays, rivers) ♦ Communicate scientific information or ideas about local weather patterns ♦ Communicate scientific information or ideas about seasonal changes ♦ Communicate scientific information or ideas about local weather conditions
Earth and Human Activity	**1. Asking questions/defining problems** ♦ Record relevant questions about how people affect the land, water, air, and/or living things in positive and negative ways based on observations ♦ Record relevant questions about how people use natural resources based on observations ♦ Record relevant questions about how to prepare for different weather based on a forecast	**3. Analyzing and interpreting data** ♦ Group information/data about the ways in which individuals conserve natural resources (e.g., reusing, recycling, repurposing) ♦ Compare predictions to the data and/or observations from an investigation about the ways in which individuals can reduce the consumption of natural resources (e.g., reusing, recycling, repurposing)	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain the ways in which individuals conserve natural resources (e.g., reusing, recycling, repurposing) ♦ Illustrate, construct, and/or label a model to show/explain how raw materials are used as a resource (e.g., trees are turned into paper)

ENTRY POINTS to
Earth and Space Sciences Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Identify questions that can be answered by an investigation about recycling or reusing resources ♦ Define a simple problem related to how to prepare for different weather based on a forecast **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the ways in which individuals can reduce the consumption of natural resources (e.g., reusing, recycling, repurposing) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to situations in which people have an impact on their local environment ♦ Use pictures and/or drawings to collect observations related to ways in which people prepare for different weather conditions ♦ Use pictures and/or drawings to collect observations related to how natural resources are used by humans to meet their needs	**3. Analyzing and interpreting data (cont.)** ♦ Display data using a simple graph or picture to show ways in which people prepare for different weather conditions ♦ Display data using a simple graph or picture to show situations in which people have an impact on their local environment **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the frequency of recycling items (e.g., locally, classroom) ♦ Use counting and numbers to show data about the different types of local weather events (e.g., number of snowstorms in winter, hurricanes in summer/fall)	**5. Developing and using models (cont.)** ♦ Illustrate, construct, and/or label a model to show/explain situations in which people have an impact on their local environment **6. Constructing explanations** ♦ Generate a solution to a problem related to local human activities on the environment using pictures or drawings. ♦ Describe the ways in which individuals can reduce the consumption of natural resources (e.g., reusing, recycling, repurposing) ♦ Describe ways in which people prepare for different weather conditions ♦ Identify descriptions that match how weather forecasting can help people plan for specific types of weather from observations or media (e.g., dressing appropriately, staying indoors, close doors and windows, etc.) ♦ Identify descriptions that match how individuals can reduce the consumption of natural resources from observations or media (e.g., reusing, recycling, repurposing) **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how people affect the land, water, air, and/or living things in positive and negative ways

ENTRY POINTS to
Earth and Space Sciences Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)			**7. Engaging in argument from evidence (cont.)** ♦ Use scientific evidence in support of an argument about ways in which people prepare for different weather conditions **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about solutions that reduce the consumption of natural resources (e.g., reusing, recycling, repurposing) ♦ Recall and present information from observations, text, or media source about how weather forecasting can help people plan for specific types of weather ♦ Communicate scientific information or ideas about individuals' use of natural resources ♦ Communicate scientific information or ideas about how the actions people take can impact the land, water, air, and/or living things in the local environment

Grade Level: Grade 3

Core Idea	Learning Standards as written	
Earth's Systems	**3-ESS2-1**	Use graphs and tables of local weather data to describe and predict typical weather during a particular season in an area. Clarification Statements: ♦ Examples of weather data could include temperature, amount and type of precipitation (e.g., rain, snow), wind direction, and wind speed. ♦ Graphical displays should focus on pictographs and bar graphs.
	3-ESS2-2	Obtain and summarize information about the climate of different regions of the world to illustrate that typical weather conditions over a year vary by region. Clarification Statement: ♦ Examples of information can include climate data (average temperature, average precipitation, average wind speed) or comparative descriptions of seasonal weather for different regions.
Earth and Human Activity	**3-ESS3-1**	Evaluate the merit of a design solution that reduces the damage caused by weather. * Clarification Statement: ♦ Examples of design solutions to reduce weather-related damage could include a barrier to prevent flooding, a wind-resistant roof, and a lightning rod.

Grade Level: Grade 4

Core Idea	Learning Standards as written	
Earth's Place in the Universe	**4-ESS1-1**	Use evidence from a given landscape that includes simple landforms and rock layers to support a claim about the role of erosion or deposition in the formation of the landscape over long periods of time. Clarification Statements: ♦ Examples of evidence and claims could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from deposition on land to deposition in water over time; and a canyon with rock layers in the walls and a river in the bottom, indicating that a river eroded the rock over time. ♦ Examples of simple landforms can include valleys, hills, mountains, plains, and canyons. ♦ Focus should be on relative time.
Earth's Systems	**4-ESS2-1**	Make observations and collect data to provide evidence that rocks, soils, and sediments are broken into smaller pieces through mechanical weathering and moved around through erosion. Clarification Statements: ♦ Mechanical weathering processes can include frost wedging, abrasion, and tree root wedging. ♦ Erosion can include movement by blowing wind, flowing water, and moving ice.
	4-ESS2-2	Analyze and interpret maps of Earth's mountain ranges, deep ocean trenches, volcanoes, and earthquake epicenters to describe patterns of these features and their locations relative to boundaries between continents and oceans.
Earth and Human Activity	**4-ESS3-1**	Obtain information to describe that energy and fuels humans use are derived from natural resources and that some energy and fuel sources are renewable and some are not. Clarification Statements: ♦ Examples of renewable energy resources could include wind energy, water behind dams, tides, and sunlight. ♦ Non-renewable energy resources are fossil fuels and nuclear materials.
	4-ESS3-2	Evaluate different solutions to reduce the impacts of a natural event such as an earthquake, blizzard, or flood on humans.* Clarification Statement: ♦ Examples of solutions could include an earthquake-resistant building or a constructed wetland to mitigate flooding.

Grade Level: Grade 5

Core Idea	Learning Standards as written	
Earth's Place in the Universe	**5-ESS1-1**	Use observations, first-hand and from various media, to argue that the Sun is a star that appears larger and brighter than other stars because it is closer to Earth.
	5-ESS1-2	Use a model to communicate Earth's relationship to the Sun, Moon, and other stars that explain (a) why people on Earth experience day and night, (b) patterns in daily changes in length and direction of shadows over a day, and (c) changes in the apparent position of the Sun, Moon, and stars at different times during a day, over a month, and over a year. Clarification Statement: ♦ Models should illustrate that the Earth, Sun, and Moon are spheres; include orbits of the Earth around the Sun and of the Moon around Earth; and demonstrate Earth's rotation about its axis.
Earth's Systems	**5-ESS2-1**	Use a model to describe the cycling of water through a watershed through evaporation, precipitation, absorption, surface runoff, and condensation.
	5-ESS2-2	Describe and graph the relative amounts of salt water in the ocean; fresh water in lakes, rivers, and groundwater; and fresh water frozen in glaciers and polar ice caps to provide evidence about the availability of fresh water in Earth's biosphere.
Earth and Human Activity	**5-ESS3-1**	Obtain and combine information about ways communities reduce human impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process. Clarification Statement: ♦ Examples of changed practices or processes include treating sewage, reducing the amounts of materials used, capturing polluting emissions from factories or power plants, and preventing runoff from agricultural activities.
	5-ESS3-2(MA)	Test a simple system designed to filter particulates out of water and propose one change to the design to improve it.*

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about fossils or rock layers ♦ Use observations and/or data to ask relevant questions about landforms and how they were created ♦ Use observations and/or data to ask relevant questions about why people on Earth experience day and night ♦ Identify questions that can be answered by an investigation about the impact of the relative positions of the Earth, Moon, and Sun ♦ Identify questions that can be answered by an investigation about the pattern of how shadows change over the course of a day ♦ Use observations and/or data to ask relevant questions about weathering and erosion ♦ Identify questions that can be answered by an investigation about weathering and erosion ♦ Generate scientific questions about weathering and erosion **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how erosion and deposition change the Earth's surface features over long periods of time ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how the Sun's apparent position in the sky affects the length and direction of shadows	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about landforms and how they were created ♦ Use data and/or observations to identify patterns about how the Sun's apparent position in the sky affects the length and direction of shadows. ♦ Use data and/or observations to identify patterns about changes in the apparent position of the Sun, Moon, and/or stars during a day, over a month, and over a year ♦ Use data and/or observations to identify relationships between the distance and brightness of stars (e.g., why the Sun appears larger and brighter than other stars) **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the changes in the number of hours of daylight versus night during the year ♦ Organize the qualitative and quantitative information about changes in landforms over time (e.g., timeline of events)	**5. Developing and using models** ♦ Illustrate or develop a model to show/explain the position of the Earth over the course of a year relative to the Sun ♦ Illustrate or develop a model to show/explain the position of the Moon over the course of a month relative to the Earth ♦ Illustrate or develop a model to show/explain the orbital relationship between the Earth, Sun, and Moon ♦ Illustrate or develop a model to show/explain how Earth's rotation about its axis creates day versus night ♦ Illustrate or develop a model of simple landforms caused by deposition or erosion ♦ Illustrate or develop a model to show/explain how the Sun is brighter and larger than other stars due to its distance from the Earth **6. Constructing explanations** ♦ Describe the duration of day and night based on the season and the position of Earth relative to the sun ♦ Explain how the Sun appears to be brighter and larger than other stars due to its relative position to the Earth ♦ Explain how deposition or erosion can alter simple landforms ♦ Explain how the Sun's apparent position in the sky affects the length and direction of shadows.

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how the Earth's relationship with the Sun affects day and night on the Earth's surface ♦ Record observations (e.g., firsthand experiences, media) to collect data related to why the Sun appears larger and brighter than other stars		**7. Engaging in argument from evidence** ♦ Use scientific evidence in support of a claim that deposition or erosion can alter a specific landscape over time ♦ Use scientific evidence in support of a claim that the position of the Earth and Sun cause day and night to occur **8. Obtaining, evaluating, and communicating information** ♦ Research and present information showing how the Earth's relationship to the Sun affects day and night ♦ Research and present information showing how the Earth's relationship to the Sun affects length and duration of shadows ♦ Research and present information showing how landforms change over time from deposition and/or erosion
Earth's Systems	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about the water cycle ♦ Use observations and/or data to ask relevant questions about patterns of the Earth's features (e.g., volcanoes, mountain ranges, ocean trenches) ♦ Use observations and/or data to ask relevant questions about weather patterns (e.g., comparing seasons, comparing locations, typical local weather)	**3. Analyzing and interpreting data** ♦ Use data and/or observations to identify patterns about the water cycle ♦ Use data and/or observations to identify relationships between landform patterns and the boundaries between continents and oceans (e.g., maps displaying ocean trenches and volcanic rings) ♦ Compare predictions to the data and/or observations from an investigation about the water cycle	**5. Developing and using models** ♦ Compare models of climates of different regions of the world to illustrate typical weather conditions (e.g., polar/cold compared to tropical/hot) ♦ Illustrate or develop a model to show/explain the water cycle ♦ Illustrate or develop a model to show/explain changes in the Earth's surface due to erosion and weathering ♦ Illustrate or develop a map to show/explain the boundaries between continents and oceans

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Identify questions that can be answered by an investigation about weathering and erosion ♦ Define a simple problem that can be solved related to the availability of fresh water (e.g., the proportion of fresh water to salt water) ♦ Generate scientific questions about climates in different regions of the Earth ♦ Identify questions that can be answered by an investigation about the water cycle **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about erosion and weathering ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the water cycle ♦ Select the best method to collect data and/or observations about weather patterns ♦ Record observations (e.g., firsthand experiences, media) to collect data related to climates in different regions of the Earth ♦ Identify changes in the Earth's surface as a result of researching and recording data on volcanic activity and earthquakes ♦ Identify examples of changes to the Earth's surface due to erosion or weathering, based on data recorded from observations and/or research	**3. Analyzing and interpreting data (cont.)** ♦ Display data using a simple graph to show temperatures for a location to determine a pattern of seasonal temperatures (e.g., in MA, colder in the winter, warmer in the summer) ♦ Display data using a simple graph to show rain/snow amounts for a location to determine a pattern of seasonal rainfall/snowfall (e.g., in MA more rain in spring; most of the snow in the winter; none in the summer) ♦ Draw conclusions based on evidence (e.g., from an investigation) about patterns of temperature and/or rainfall/snowfall **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the relative amounts of salt water in the ocean; fresh water in lakes, rivers, and ground water; and fresh water frozen in glaciers and polar ice caps (e.g.; table or graph) ♦ Organize the qualitative and quantitative information about climates of different regions of the world ♦ Order the average temperature each month in a table or chart from lowest to highest for a specific location ♦ Order the amount of rain/snow in a table or chart from lowest to highest each month for a specific location	**5. Developing and using models (cont.)** ♦ Illustrate or develop a map to show/explain the patterns of ocean trenches, mountain ranges, volcanoes, and earthquake epicenters around the world **6. Constructing explanations** ♦ Describe the cycling of water and its components (evaporation, precipitation, absorption, surface runoff, and condensation) ♦ Explain how the climate data (e.g., average temperature, precipitation) varies in different seasons for different regions ♦ Explain the difference between weathering and erosion ♦ Describe the relationship between the relative amounts of salt water to fresh water **7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that typical weather conditions can vary by climate region ♦ Use scientific evidence from data to support a claim about the availability of fresh water **8. Obtaining, evaluating, and communicating information** ♦ Communicate scientific information (orally, graphically, textually, and/or mathematically) about local weather in a particular season

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Identify natural sources of fresh water (e.g., groundwater, lakes, rivers, and glaciers) based on observations, research, and recording data ♦ Record observations (e.g. first-hand experiences, media) to collect data related to the water cycle		**8. Obtaining, evaluating, and communicating information** ♦ Communicate scientific information (orally, graphically, textually, and/or mathematically) about the climate of different regions of the world (e.g., typical weather conditions) ♦ Research and present information from an investigation about the water cycle ♦ Research and present information from an investigation about the changes in the Earth's surface due to erosion and/or weathering ♦ Research and present information about the features (e.g., mountain ranges, deep ocean trenches, volcanoes, earthquake epicenters) to describe the patterns between continents and oceans ♦ Communicate scientific information (orally, graphically, textually and/or mathematically) about the water cycle
Earth and Human Activity	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about impact of human activities on the environment ♦ Use observations and/or data to ask relevant questions about renewable versus non-renewable energy ♦ Identify questions that can be answered by an investigation about how pollution or runoff is caused by human impact ♦ Define a simple problem that can be solved related to filtering water	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation related to filtering particles from water ♦ Use data and/or observations to identify relationships between the impact of human activities and the environment (e.g., pollution, runoff)	**5. Developing and using models** ♦ Compare models of solutions that mitigate damage caused by weather ♦ Compare models of solutions that mitigate damage caused by natural events ♦ Compare models of renewable and non-renewable energy sources to identify common features and differences. ♦ Illustrate or develop a model to show/explain the impact of human activities and the environment (e.g., pollution, runoff)

ENTRY POINTS to Earth and Space Sciences Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Define a simple problem that can be solved related to the impact of natural events (e.g., hurricanes, fire, blizzards, floods) on humans ♦ Define a simple problem that can be solved related to the impact of damage caused by weather (e.g., windbreak, lightning rod, landscaping features such as rock walls, wetlands) on humans **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about different designs for filtering particles out of water (e.g., coffee filter, charcoal, sand, screen) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to damage caused by natural events ♦ Record observations (e.g., firsthand experiences, media) to collect data related to damage caused by weather ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how communities can reduce the human impact on Earth's resources and environment ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the energy and fuel sources that are renewable and non-renewable	**3. Analyzing and interpreting data (cont.)** ♦ Display data using a simple graph to show how humans use different forms of renewable and non-renewable energy sources ♦ Draw conclusions based on evidence (e.g., from an investigation) about damage caused by weather ♦ Draw conclusions based on evidence (e.g., from an investigation) about damage caused by natural events **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the effectiveness of a water filter ♦ Organize the qualitative and quantitative information about damage caused by weather ♦ Organize the qualitative and quantitative information about damage caused by natural events	**5. Developing and using models (cont.)** ♦ Illustrate or develop a model to show/explain the best solution for filtering particles out of water **6. Constructing explanations** ♦ Use tools and/or materials to build a device that solves a specific problem about filtering particles out of water ♦ Draw and/or explain a design solution that reduces the damage caused by weather ♦ Draw and/or explain a design solution that reduces the impact of a natural event ♦ Describe different sources of renewable and non-renewable energy ♦ Describe how agricultural and industrial pollution impact the environment **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of a claim about how different sources of energy impact the environment ♦ Use scientific evidence in support of a claim about how runoff from agricultural activities impacts the environment ♦ Use scientific evidence to support a claim for or against a design solution about the effectiveness of a water filter ♦ Use scientific evidence to support a claim for or against a design solution to prevent damage from natural events

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)			**8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about how pollution and runoff (e.g., agricultural activities) impacts the environment ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about different solutions that filter particles out of water ♦ Research and present information about solutions to prevent damage caused by natural events ♦ Research and present information about solutions to prevent damage caused by weather ♦ Research and present information about renewable and non-renewable energy sources

Grade Level: Grade 6

Core Idea	Learning Standards as written	
Earth's Place in the Universe	**6.MS-ESS1-1a**	Develop and use a model of the Earth-Sun-Moon system to explain the causes of lunar phases and eclipses of the Sun and Moon. Clarification Statement: ♦ Examples of models can be physical, graphical, or conceptual and should emphasize relative positions and distances.
	6.MS-ESS1-4	Analyze and interpret rock layers and index fossils to determine the relative ages of rock formations that result from processes occurring over long periods of time. Clarification Statements: ♦ Analysis includes laws of superposition and crosscutting relationships limited to minor displacement faults that offset layers. ♦ Processes that occur over long periods of time include changes in rock types through weathering, erosion, heat, and pressure.
	6.MS-ESS1-5(MA)	Use graphical displays to illustrate that Earth and its solar system are one of many in the Milky Way galaxy, which is one of billions of galaxies in the universe. Clarification Statement: ♦ Graphical displays can include maps, charts, graphs, and data tables.
Earth's Systems	**6.MS-ESS2-3**	Analyze and interpret maps showing the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence that Earth's plates have moved great distances, collided, and spread apart. Clarification Statement: ♦ Maps may show similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches), similar to Wegener's visuals.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
Earth's Systems	**7.MS-ESS2-2**	Construct an explanation based on evidence for how Earth's surface has changed over scales that range from local to global in size. Clarification Statements: ♦ Examples of processes occurring over large, global spatial scales include plate motion, formation of mountains and ocean basins, and ice ages. ♦ Examples of changes occurring over small, local spatial scales include earthquakes and seasonal weathering and erosion.
	7.MS-ESS2-4	Develop a model to explain how the energy of the Sun and Earth's gravity drive the cycling of water, including changes of state, as it moves through multiple pathways in Earth's hydrosphere. Clarification Statement: ♦ Examples of models can be conceptual or physical.
Earth and Human Activity	**7.MS-ESS3-2**	Obtain and communicate information on how data from past geologic events are analyzed for patterns and used to forecast the location and likelihood of future catastrophic events. Clarification Statements: ♦ Geologic events include earthquakes, volcanic eruptions, floods, and landslides. ♦ Examples of data typically analyzed can include the locations, magnitudes, and frequencies of the natural hazards.
	7.MS-ESS3-4	Construct an argument supported by evidence that human activities and technologies can mitigate the impact of increases in human population and per capita consumption of natural resources on the environment. Clarification Statements: ♦ Arguments should be based on examining historical data such as population graphs, natural resource distribution maps, and water quality studies over time. ♦ Examples of negative impacts can include changes to the amount and quality of natural resources such as water, mineral, and energy supplies.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
Earth's Place in the Universe	**8.MS-ESS1-1b**	Develop and use a model of the Earth-Sun system to explain the cyclical pattern of seasons, which includes Earth's tilt and differential intensity of sunlight on different areas of Earth across the year. Clarification Statement: ♦ Examples of models can be physical or graphical.
	8.MS-ESS1-2	Explain the role of gravity in ocean tides, the orbital motions of planets, their moons, and asteroids in the solar system.
Earth's Systems	**8.MS-ESS2-1**	Use a model to illustrate that energy from Earth's interior drives convection that cycles Earth's crust, leading to melting, crystallization, weathering, and deformation of large rock formations, including generation of ocean sea floor at ridges, submergence of ocean sea floor at trenches, mountain building, and active volcanic chains. Clarification Statement: ♦ The emphasis is on large-scale cycling resulting from plate tectonics
	8.MS-ESS2-5	Interpret basic weather data to identify patterns in air mass interactions and the relationship of those patterns to local weather. Clarification Statements: ♦ Data includes temperature, pressure, humidity, precipitation, and wind. ♦ Examples of patterns can include air masses flow from regions of high pressure to low pressure, and how sudden changes in weather can result when different air masses collide. ♦ Data can be provided to students (such as in weather maps, data tables, diagrams, or visualizations) or obtained through field observations or laboratory experiments.
	8.MS-ESS2-6	Describe how interactions involving the ocean affect weather and climate on a regional scale, including the influence of the ocean temperature as mediated by energy input from the Sun and energy loss due to evaporation or redistribution via ocean currents. Clarification Statement: ♦ A regional scale includes a state or multi-state perspective.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
Earth and Human Activity	**8.MS-ESS3-1**	Analyze and interpret data to explain that the Earth's mineral and fossil fuel resources are unevenly distributed as a result of geologic processes. Clarification Statement: ♦ Examples of uneven distributions of resources can include where petroleum is generally found (locations of the burial of organic marine sediments and subsequent geologic traps), and where metal ores are generally found (locations of past volcanic and hydrothermal activity).
	8.MS-ESS3-5	Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century. Clarification Statements: ♦ Examples of human activities include fossil fuel combustion, deforestation, and agricultural activity. ♦ Examples of evidence can include tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; and the rates of human activities.

ENTRY POINTS to Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in an investigation about how the Earth rotates on its axis (e.g., time of year, hemisphere, length of day) ♦ Ask questions about what would happen if a variable was changed in an investigation about phases of the moon (e.g., monthly cycle, relative position of Earth/moon/Sun) ♦ Identify scientific (testable) and non-scientific (non-testable) questions about the phases of the Moon after making observations ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a problem related to ocean tides ♦ Ask questions about the formation of different layers of rock or the relative ages of layers of rocks, including fossils found in the layers of rock **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about the conditions under which a type of rock layer is formed over time (e.g., heat, pressure, weathering, sedimentation) to produce data/observations to serve as evidence	**3. Analyzing and interpreting data** ♦ Use observations and/or data from an investigation to determine the cause of the phases of the moon over the course of a month ♦ Represent data visually (e.g., models, pictographs) to reveal patterns about the cause of the phases of the moon over the course of a month ♦ Represent data visually (e.g., pictographs, time charts, graphs) to reveal patterns about the relationship between the moon's position and ocean tides ♦ Analyze and interpret data about the relative position of the Earth and the Sun to reveal patterns about seasonal changes (e.g., given diagrams of the Earth's tilt and the Sun's position, determine the season in each hemisphere) ♦ Analyze and interpret data about the age of various rock layers containing fossils (e.g., laws of superposition, cross cutting relationships) ♦ Compare and contrast data/observations showing various rock layers and the conditions under which they were formed over time ♦ Use observations and/or data to evaluate and/or refine design solutions related to ocean tides	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain how the tilt of the Earth and position of the Earth relative to the Sun relate to seasonal changes ♦ Develop, revise, and/or use a model of the Earth-Sun-Moon system to show/explain the role of gravity in determining ocean tides ♦ Develop, revise, and/or use a model of the Earth-Sun-Moon system to show/explain the orbital motions of planets in the solar system ♦ Develop, revise, and/or use a model of the Earth-Sun-Moon system to show/explain eclipses of the Sun and Moon ♦ Develop, revise, and/or use a model to show/explain the structure of the universe, how there are many solar systems in a galaxy, and many galaxies in the universe **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence about the ages of various rock layers (e.g., based on fossils) ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about the cause of lunar phases or eclipses

ENTRY POINTS to Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about tide variations in different coastal locations ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about indexing fossils to determine the relative ages of rock formations ♦ Test two different models of the same proposed design solution related to ocean tides to determine which better meets criteria for success.	**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the cause of the phases of the moon over the course of a month ♦ Use computations (e.g., addition, subtraction) to analyze data (e.g., averages, totals, differences) about ocean tides ♦ Describe, measure, and/or compare quantitative attributes of changes in the number of hours of daylight in different locations (e.g., Anchorage, Alaska; Boston, Massachusetts) on the same dates	**6. Constructing explanations (cont.)** ♦ Generate and compare multiple solutions to a problem related to ocean tides (e.g., compare the benefits/drawbacks of each solution) ♦ Explain the relationship between the universe, galaxies, and solar systems (e.g., how there are many solar systems in a galaxy, and many galaxies in the universe) ♦ Explain how the gravity of the Sun and Moon affects ocean tides **7. Engaging in argument from evidence** ♦ Critique an argument citing evidence from informational sources about the causes of eclipses or lunar phases ♦ Defend a claim that the ages of rock formations can be determined by using fossils as evidence ♦ Critique an argument citing evidence from informational sources about the cause of seasonal changes **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain how gravity causes tides ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the causes of seasons ♦ Research, record, and/or present information describing how the tilt of the Earth's axis and the position of Earth relative to the Sun are responsible for seasonal changes

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in an investigation about weather (e.g., temperature, humidity, wind) ♦ Identify scientific (testable) and non-scientific (non-testable) questions about the movement of the earth's crustal plates ♦ Generate scientific questions about the locations of volcanic and/or earthquake activity based on research and/or observations ♦ Generate scientific questions about ocean currents and how they affect weather and climate in different regions based on research and/or observations ♦ Generate scientific questions about the water cycle based on research and/or observations **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about how air moves from areas of higher to lower pressure to produce data/observations to serve as evidence for resulting weather ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about how the Sun's energy influences the cycling of water	**3. Analyzing and interpreting data** ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about local weather ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about how the ocean affects weather ♦ Analyze and interpret data to make sense of the causes of various catastrophic weather events ♦ Compare and contrast data showing patterns about weather in different geographic locations including temperature, humidity, and precipitation **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about weather including temperature, humidity, and precipitation ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about the movement of the Earth's crustal plates (e.g., earthquake strength versus destruction) ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) about weather	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain how ocean currents affect weather and climate in different regions (e.g., jet stream, El Niño) ♦ Develop, revise, and/or use a model to show/explain the movement of Earth's crustal plates ♦ Develop, revise, and/or use a model to show/explain how the cycling of water affects a watershed ♦ Develop, revise, and/or use a model to show/explain how the state of water changes as it moves through the Earth's hydrosphere (e.g., evaporation, condensation) ♦ Develop, revise, and/or use a model to show/explain how local weather is affected by patterns of movement of air masses **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how the Earth's surface can be built up/ eroded by the cycling of water ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how the Earth's crustal plates have moved over time ♦ Explain how certain features of the earth formed the way they did (e.g., lakes, ocean trenches, mountains, canyons) ♦ Explain how the energy of the Sun and Earth's gravity drive the cycling of water

ENTRY POINTS to Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about how the movement of tectonic plates influence the formation of landforms ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about how the Earth's surface that have been built up/eroded by the cycling of water ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the movement of Earth's crustal plates (e.g., distribution of fossils, earthquakes, volcanos, landforms)		**6. Constructing explanations (cont.)** ♦ Explain how convection results in the shifting of Earth's crustal plates (e.g., plate tectonics) ♦ Explain the relationship between the ocean and weather (e.g., prevailing winds, ocean currents) **7. Engaging in argument from evidence** ♦ Compare and critique two arguments about how certain features of the Earth formed the way they did (e.g., volcanoes, ocean trenches) ♦ Use scientific evidence and observations to construct an argument about why the weather is different in two particular locations ♦ Use scientific evidence and observations to construct an argument about how an extreme weather event occurred (e.g., hail, tornado, thunderstorm) **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain the effects of the movement of the Earth's crustal plates (e.g., landforms, earthquakes) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how the Sun's energy and Earth's gravity influence the cycling of water ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how tectonic plates have moved great distances over time

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research and/or present information showing how ocean currents affect weather and climate in different regions (e.g., Gulf Stream creates milder winter conditions in Northern Europe) ♦ Research and/or present information showing how the Earth's surface has been built up/eroded by the cycling of water
Earth and Human Activity	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if the human population continues to increase and natural resources (e.g., water, energy supplies) continue to diminish ♦ Use prior knowledge to describe problems that can be solved by forecasting geological events (e.g., earthquakes, floods) ♦ Generate scientific questions about climate change based on research and/or observations ♦ Generate scientific questions about fossil fuel distribution on Earth based on research and/or observations ♦ Generate scientific questions about human activities and technologies that can impact the use of natural resources based on research and/or observations	**3. Analyzing and interpreting data** ♦ Use observations and/or data to determine the likelihood of future geologic events in a certain location based on data from past geological events (e.g., earthquakes, volcanic eruptions, floods, landslides) ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the Earth's mineral and fossil fuel resources ♦ Analyze and interpret data to make sense of the rise in global temperatures ♦ Compare and contrast data showing the increase of human population to the impact on natural resources ♦ Use observations and/or data to evaluate and/or refine design solutions related to the technologies that can slow the depletion of natural resources (e.g., switching to renewable energy resources)	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain the location of large concentrations of the Earth's minerals and fossil fuels on a map ♦ Develop, revise, and/or use a model to show/explain the geologic processes that resulted in uneven distribution of Earth's resources (e.g., earthquakes, volcanic eruptions, hydrothermal activity) ♦ Develop, revise, and/or use a model to illustrate examples of human activities that impact the rise of global temperatures (e.g., fossil fuel combustion, deforestation, agriculture)

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about human population and per capita consumption of natural resources to produce data/observations to serve as evidence ♦ Plan and/or conduct an investigation about how human activity impacts the levels of atmospheric gases (e.g., carbon dioxide, methane) ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about climate change ♦ Record observations to produce data to serve as evidence about geological events and their impact on humans and environment (e.g., earthquakes, volcanic eruptions, floods, landslides) ♦ Record observations to produce data to serve as evidence about how human activities can cause global climate change ♦ Record observations to produce data about how human activities have caused a depletion of natural resources (e.g., water, mineral, and energy supplies) ♦ Test two different technologies of the same proposed design solution related to climate change to determine which better meets criteria for success (e.g., wind farm vs solar)	**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about catastrophic events on Earth (e.g., landslides, floods, earthquakes, volcanoes) ♦ Organize simple data sets to reveal patterns about the changes in global temperatures over the past century due to human activities (e.g., atmospheric levels of gases such as carbon dioxide, the use of fossil fuels) ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about global temperature rise related to human activity	**6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about geological events and their impact on humans and environment (e.g., earthquakes, volcanic eruptions, floods, landslides) ♦ Generate and compare multiple solutions to a problem related to climate change ♦ Use observations and data from investigations to design a solution to a problem related to human population and the use of natural resources ♦ Explain how technology can mitigate the effects of human use of natural resources to slow or eliminate changes to Earth's systems **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about how human activities may have caused global climate change ♦ Defend a claim about the merit of a design solution to mitigate the effects of rising global temperatures by citing relevant evidence (e.g. alternative energy resources, alternative farming practices)

ENTRY POINTS to
Earth and Space Sciences Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity (cont.)			**8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain how human activities may have caused global climate change ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how human activities have caused a depletion of natural resources (e.g., water, mineral, and energy supplies) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how past geological events are used to forecast the likelihood of catastrophic events ♦ Research and present information on how human activities, such as deforestation, agriculture, and combustion of fossil fuels, has contributed to global climate change

Science and Technology/Engineering
Pre-K–Grade 8

LIFE SCIENCE

Core Idea	Access Skills	Grades Pre-K–2	Grades 3–5	Grades 6–8
From Molecules to Organisms: Structures and Processes	Pages 51–53	Pages 47–49, 61–63	Pages 71, 73–76	Pages 85, 87, 89, 91–93
Ecosystems: Interactions, Energy, and Dynamics	Pages 53–55	Pages 47, 50 63–66	Pages 74, 77–78	Pages 87–88, 94–96
Heredity: Inheritance and Variation of Traits	Pages 56–58	Pages 47, 49 66–68	Pages 71, 78–80	Pages 89–90, 97–98
Biological Evolution: Unity and Diversity	Pages 58–60	Pages 50, 68–70	Pages 71–72, 80–84	Pages 86, 90, 98–101

Grade Level: Pre-Kindergarten

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**PreK-LS1-1(MA)**	Compare, using descriptions and drawings, the external body parts of animals (including humans) and plants and explain functions of some of the observable body parts. Clarification Statement: ♦ Examples can include comparison of humans and horses: humans have two legs and horses four, but both use legs to move.
	PreK-LS1-2(MA)	Explain that most animals have five senses they use to gather information about the world around them.
	PreK-LS1-3(MA)	Use their five senses in their exploration and play to gather information.
Ecosystem: Interaction, Energy, and Dynamics	**PreK-LS2-1(MA)**	Use evidence from animals and plants to define several characteristics of living things that distinguish them from non-living things.
	PreK-LS2-2(MA)	Using evidence from the local environment, explain how familiar plants and animals meet their needs where they live. Clarification Statements: ♦ Basic needs include water, food, air, shelter, and, for most plants, light. ♦ Examples of evidence can include squirrels gathering nuts for the winter and plants growing in the presence of sun and water. ♦ The local environment includes the area around the student's school, home, or adjacent community.
	PreK-LS2-3(MA)	Give examples from the local environment of how animals and plants are dependent on one another to meet their basic needs.
Heredity: Inheritance and Variation of Traits	**PreK-LS3-1(MA)**	Use observations to explain that young plants and animals are like but not exactly like their parents. Clarification Statement: ♦ Examples of observations include puppies that look similar but not exactly the same as their parents.
	PreK-LS3-2(MA)	Use observations to recognize differences and similarities among themselves and their friends.

Grade Level: Kindergarten

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**K-LS1-1**	Observe and communicate that animals (including humans) and plants need food, water, and air to survive. Animals get food from plants or other animals. Plants make their own food and need light to live and grow.
	K-LS1-2(MA)	Recognize that all plants and animals grow and change over time.

Grade Level: Grade 1

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**1-LS1-1**	Use evidence to explain that (a) different animals use and take in food, water, and air, and (b) plants have roots, stems, leaves, flowers, and fruits that are used to take in water, air, and other nutrients, and produce food for the plant. Clarification Statement: ♦ Descriptions are not expected to include mechanisms such as the process of photosynthesis.
	1-LS1-2	Obtain information to compare ways in which the behavior of different animal parents and their offspring help the offspring to survive. Clarification Statement: ♦ Examples of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).
Heredity: Inheritance and Variation of Traits	**1-LS3-1**	Use information from observations (first-hand and from media) to identify similarities and differences among individual plants or animals of the same kind. Clarification Statements: ♦ Examples of observations could include that leaves from the same kind of plant are the same shape but can differ in size. ♦ Inheritance, animals that undergo metamorphosis, or hybrids are not expected.

Grade Level: Grade 2

Core Idea	Learning Standards as written	
Ecosystems: Interactions, Energy, and Dynamics	**2-LS2-3(MA)**	Develop and use models to compare how plants and animals depend on their surroundings and other living things to meet their needs in the places they live. Clarification Statement: ♦ Animals need food, water, air, shelter, and favorable temperature; plants need sufficient light, water, minerals, favorable temperature, and animals or other mechanisms to disperse seeds.
Biological Evolution: Unity and Diversity	**2-LS4-1**	Use texts, media, or local environments to observe and compare (a) different kinds of living things in an area, and (b) differences in the kinds of living things living in different types of areas. Clarification Statements: ♦ Examples of areas to compare can include temperate forest, desert, tropical rain forest, grassland, arctic, and aquatic. ♦ Specific animal and plant names in specific areas are not expected.

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes	**1. Asking questions/defining problems** ♦ Explore materials visually or by touch that represent body parts, body systems, senses, parts of plants, life cycle(s) or cells (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time of the activity being interrupted ♦ Gain attention within a specified time block(s) to explore materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Make a request to explore materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time ♦ Choose within a specified amount of time from an errorless array of materials related to body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Match object to object, or picture to picture, of materials related to body parts, body systems, senses, parts of plants, life cycle(s), or cells ♦ Activate a device (within a specified amount of time) in a model representing the parts of a plant and/or animal **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells for a specified amount of time	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells for a specified amount of time in a comparison activity ♦ Release or give materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time in a comparison activity ♦ Turn on/off technology representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time in a comparison activity ♦ Move materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells in a comparison activity ♦ Use two hands to manipulate materials representing body parts, body systems, senses, parts of plants, life cycle(s) or cells in a comparison activity ♦ Imitate action representing body parts, body systems, senses, parts of plants, life cycle(s) or cells in a comparison activity ♦ Initiate cause and effect response representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified time block(s) in a comparison activity **4. Using mathematics and computational thinking** ♦ Track materials in the creation of a table, chart, or graph to demonstrate how plants or animals grow and change over time	**5. Developing and using models** ♦ Track materials (shift focus from materials to speaker) in a model representing the parts of a plant and/or animal ♦ Orient or manipulate a model representing the parts of a plant and/or animal ♦ Functionally use materials related to a model representing the parts of a plant and/or animal ♦ Locate objects partially hidden or out of sight of a model representing the parts of a plant and/or animal ♦ Construct or assemble a model representing the parts of a plant and/or animal ♦ Use one object to act on another in a model representing the parts of a plant and/or animal ♦ Visually attend to (specify criteria) the creation, illustration or labeling of a model representing the parts of a plant and/or animal ♦ Grasp (hold) materials within a specified amount of time based on a model representing the parts of a plant and/or animal ♦ Use one object to act on another in the creation of a model representing the five senses ♦ Visually attend to (specify criteria) the creation, illustration or labeling of a model representing the life cycle of a plant/how a plant changes over time ♦ Activate a device (within a specified amount of time) in a model representing the parts of a plant and/or animal ♦ Activate a device (within a specified amount of time) to record relevant questions related to body parts, body systems, senses, parts of plants, life cycle(s) or cells **6. Constructing explanations** ♦ Orient or manipulate materials related to the creation of a written product to describe how plants and/or animals grow and change over time

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Release or give materials in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time of the directive ♦ Turn on/off technology in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time ♦ Move materials in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Use two hands in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Imitate action in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Initiate cause and effect response in an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of materials during an investigation on body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Explore materials visually or by touch during an investigation about body parts, body systems, senses, parts of plants, life cycle(s) or cells (specify accuracy criteria)	**4. Using mathematics and computational thinking (cont.)** ♦ Orient or manipulate materials in the creation of a table, chart, or graph to demonstrate how plants or animals grow and change over time ♦ Functionally use materials in the creation of a table, chart, or graph to demonstrate how plants or animals grow and change over time ♦ Use one object to act on another in the creation of a table, chart, or graph demonstrating how plants or animals grow and change over time (e.g., glue stick to adhere materials to graph) ♦ Respond, within a specified amount of time, to counting and/or numbers to show data about the five senses	**7. Engaging in argument from evidence** ♦ Initiate a cause-and-effect response within a specified amount of time, related to the creation of a written product to support an argument on how plants and/or animals grow and change over time **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing how plants and/or animals grow and change over time ♦ Track materials to communicate ideas/information representing about the five senses ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing how plants and/or animals grow and change over time ♦ Turn on/off technology to communicate ideas/information representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time in a comparison activity ♦ Move or functionally use materials to communicate ideas/information representing body parts, body systems, senses, parts of plants, life cycle(s) or cells (e.g., voice output, switch, low tech)

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Choose from an errorless array of materials to communicate ideas/information representing body parts, body systems, senses, parts of plants, life cycle(s) or cells within a specified amount of time ♦ Match object to object, or object to picture, or picture to picture of materials to communicate ideas/information representing body parts, body systems, senses, parts of plants, life cycle(s) or cells ♦ Initiate a cause-and-effect response within a specified amount of time, to communicate findings from an investigation on body parts, body systems, senses, parts of plants, life cycle(s) or cells
Ecosystems: Interact-ions, Energy, and Dynamics	**1. Asking questions/defining problems** ♦ Explore materials representing living versus non-living, ecosystems, food chain or food web visually or by touch specifying accuracy criteria ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing living versus non-living, ecosystems, food chain or food web within a specified amount of time of the activity being interrupted ♦ Gain attention to explore materials representing living versus non-living, ecosystems, food chain or food web within a specified time block(s)		

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Make a request to explore materials representing living versus non-living, ecosystems, food chain or food web within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array to explore materials related to living versus non-living, ecosystems, food chain or food web ♦ Match object to object, or picture to picture to explore materials representing living versus non-living, ecosystems, food chain, or food web **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about ecosystems, food chain or food web for a specified amount of time ♦ Grasp (hold) materials in an investigation about living versus non-living for a specified amount of time ♦ Release or give materials in an investigation about ecosystems, food chain or food web for a specified amount of time of the directive ♦ Release or give materials in an investigation about living versus non-living for a specified amount of time of the directive ♦ Turn on/off technology in an investigation about ecosystems, food chain or food web for a specified amount of time	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials in a comparison activity that represent living versus non-living for a specified amount of time ♦ Release or give materials in a comparison activity that represent ecosystems, food chain or food web within a specified amount of time ♦ Turn on/off technology in a comparison activity that represent living versus non-living within a specified amount of time ♦ Move materials in a comparison activity that represent ecosystems, food chain or food web ♦ Use two hands to manipulate materials in a comparison activity that represent living versus non-living ♦ Imitate action in a comparison activity that represent ecosystems, food chain or food web ♦ Initiate cause and effect in a comparison activity that represent related to living versus non-living within a specified time block(s) **4. Using mathematics and computational thinking** ♦ Track materials in the creation of a table, chart, or graph about living and non-living things within the local environment ♦ Orient or manipulate materials in the creation of a table, chart, or graph about living and non-living things within the local environment	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials used in a model of a food chain or food web ♦ Orient or manipulate materials used in a model of a food chain or food web ♦ Functionally use materials in a model of a food chain or food web ♦ Locate materials partially hidden or out of sight used in a model of a food chain or food web ♦ Construct or assemble a model of a food chain or food web (specifying accuracy criteria) ♦ Use one object to act on another in a model of food chain or food web (e.g., use a pointer to tap) **6. Constructing explanations** ♦ Orient or manipulate materials related to the creation of a written product to explain a food chain or food web **7. Engaging in argument from evidence** ♦ Initiate a cause-and-effect response within a specified amount of time, related to the creation of a written product to support an argument regarding the characteristics of living things that distinguish them from non-living things

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Turn on/off technology in an investigation about living versus non-living for a specified amount of time ♦ Move materials in an investigation about ecosystems, food chain or food web for a specified amount of time ♦ Move materials in an investigation about living versus non-living for a specified amount of time ♦ Use two hands in an investigation about ecosystems, food chain or food web for a specified amount of time ♦ Use two hands in an investigation about living versus non-living for a specified amount of time ♦ Imitate action in an investigation about ecosystems, food chain or food web for a specified amount of time ♦ Imitate action in an investigation about living versus non-living for a specified amount of time ♦ Initiate cause and effect response in an investigation about ecosystems, food chain or food web for a specified amount of time ♦ Initiate cause and effect response in an investigation about living versus non-living for a specified amount of time	**4. Using mathematics and computational thinking (cont.)** ♦ Functionally use materials in the creation of a table, chart, or graph about living and non-living things within the local environment ♦ Locate materials partially hidden or out of sight in the creation of a table, chart, or graph about living and non-living things within the local environment ♦ Use one object to act on another in the creation of a table, chart, or graph in a model representing living versus non-living things within the local environment (e.g., glue stick to adhere materials to graph)	**8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing living versus non-living within a specified time block(s) ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing ecosystems, food chain or food web ♦ Move or functionally use materials to communicate ideas/information representing living versus non-living (e.g., voice output, switch, low tech) ♦ Choose from an errorless array of materials to communicate ideas/information representing ecosystems, food chain or food web within a specified amount of time ♦ Match object to object, or object to picture, or picture to picture of materials to communicate ideas/information representing living versus non-living

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits	**1. Asking questions/defining problems** ♦ Explore materials representing parent/offspring traits, or characteristics of living things visually or tactilely (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing parent/offspring traits, or characteristics of living things within a specified amount of time of the activity being interrupted ♦ Gain attention within a specified time block(s) to explore materials representing parent/offspring traits, or characteristics of living things ♦ Make a request to explore materials representing parent/offspring traits, or characteristics of living things within a specified amount of time ♦ Match object to object, or picture to picture, to explore materials in an activity about parent/offspring traits, or characteristics of living things **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about parent/offspring traits, or similar/different characteristics of living things for a specified amount of time	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials in a comparison activity related to parent/offspring traits for a specified amount of time ♦ Grasp (hold) materials in a comparison activity related to similar/different characteristics of living things for a specified amount of time ♦ Release or give materials in a comparison activity related to parent/offspring traits for a specified amount of time ♦ Release or give materials in a comparison activity related to similar/different characteristics of living things for a specified amount of time ♦ Turn on/off technology in a comparison activity related to parent/offspring traits for a specified amount of time ♦ Turn on/off technology in a comparison activity related to similar/different characteristics of living things for a specified amount of time ♦ Move materials in a comparison activity related to parent/offspring traits ♦ Move materials in a comparison activity related to similar/different characteristics of living things ♦ Use two hands to manipulate materials in a comparison activity related to parent/offspring traits ♦ Use two hands to manipulate materials in a comparison activity related to similar/different characteristics of living things	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials used in a model of parent/offspring traits ♦ Orient or manipulate materials used in a model of parent/offspring traits ♦ Functionally use materials in a model of parent/offspring traits ♦ Locate materials partially hidden or out of sight in a model of parent/offspring traits ♦ Construct or assemble a model of parent/offspring traits specifying accuracy criteria ♦ Use one object to act on another in a model of parent/offspring traits (e.g., use a pointer to tap) **6. Constructing explanations** ♦ Orient or manipulate materials related to the creation of a written product to explain similar/different characteristics of living things **7. Engaging in argument from evidence** ♦ Initiate a cause-and-effect response within a specified amount of time, related to the creation of a written product to support an argument about why there may be similarities and differences among the same type of animal

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Release or give materials in an investigation about parent/offspring traits, or similar/different characteristics of living things within a specified amount of time of the directive ♦ Turn on/off technology in an investigation about parent/offspring traits, or similar/different characteristics of living things within a specified amount of time ♦ Move materials in an investigation about parent/offspring traits, or similar/different characteristics of living things ♦ Use two hands in an investigation about parent/offspring traits, or similar/different characteristics of living things ♦ Imitate action in an investigation about parent/offspring traits, or similar/different characteristics of living things ♦ Initiate cause and effect response in an investigation about parent/offspring traits, or similar/different characteristics of living things within a specified time block(s)	**3. Analyzing and interpreting data (cont.)** ♦ Imitate action in a comparison activity related to parent/offspring traits ♦ Imitate action in a comparison activity related to similar/different characteristics of living things ♦ Initiate cause and effect response in a comparison activity related to parent/offspring traits within a specified time block(s) ♦ Initiate cause and effect response in a comparison activity related to similar/different characteristics of living things within a specified time block(s) **4. Using mathematics and computational thinking** ♦ Track materials in the creation of a table, chart, or graph about parent/offspring traits ♦ Track materials in the creation of a table, chart, or graph about similar/different characteristics of living things ♦ Orient or manipulate materials in the creation of a table, chart, or graph about parent/offspring traits ♦ Orient or manipulate materials in the creation of a table, chart, or graph about similar/different characteristics of living things ♦ Functionally use materials in the creation of a table, chart, or graph about parent/offspring traits	**8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing parent/offspring traits ♦ Track materials to communicate ideas/information representing similar/different characteristics of living things ♦ Grasp, release or give materials to communicate ideas/information representing parent/offspring traits ♦ Grasp, release or give materials to communicate ideas/information representing similar/different characteristics of living things ♦ Move or functionally use materials to communicate ideas/information representing parent/offspring traits (e.g., voice output, switch, low tech) ♦ Move or functionally use materials to communicate ideas/information representing similar/different characteristics of living things (e.g., voice output, switch, low tech) ♦ Choose from an errorless array of materials to communicate ideas/information representing parent/offspring traits within a specified amount of time

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)		**4. Using mathematics and computational thinking (cont.)** ♦ Functionally use materials in the creation of a table, chart, or graph about similar/different characteristics of living things ♦ Locate materials partially hidden or out of sight in the creation of a table, chart, or graph about parent/offspring traits ♦ Locate materials partially hidden or out of sight in the creation of a table, chart, or graph about similar/different characteristics of living things ♦ Use one object to act on another in the creation of a table, chart, or graph about parent/offspring traits (e.g., glue stick to adhere materials to graph) ♦ Use one object to act on another in the creation of a table, chart, or graph about similar/different characteristics of living things (e.g., glue stick to adhere materials to graph)	**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Choose from an errorless array of materials to communicate ideas/information representing similar/different characteristics of living things within a specified amount of time ♦ Match object to object, or object to picture, or picture to picture of materials to communicate ideas/information representing parent/offspring traits ♦ Match object to object, or object to picture, or picture to picture of materials to communicate ideas/information representing similar/different characteristics of living things
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ♦ Explore materials representing habitats visually or by touch (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing habitats within a specified amount of time of the activity being interrupted	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials in a comparison activity related to plants and/or animals and their habitats for a specified amount of time ♦ Release or give materials in a comparison activity related to plants and/or animals and their habitats within a specified amount of time	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials used in a model of a habitat ♦ Orient or manipulate materials used in a model of a habitat ♦ Locate materials partially hidden or out of sight in a model of a habitat ♦ Construct or assemble a model of a habitat specifying accuracy criteria

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Gain attention to explore materials representing habitats within a specified time block(s) ♦ Make a request to explore materials representing habitats within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of materials related to habitats ♦ Match object to object or picture to picture of animals in habitats **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about habitats for a specified amount of time ♦ Release or give materials in an investigation about habitats within a specified amount of time of the directive ♦ Turn on/off technology in an investigation about habitats within a specified amount of time ♦ Move materials in an investigation about habitats ♦ Use two hands in an investigation about habitats ♦ Imitate action in an investigation about habitats ♦ Initiate cause and effect response in an investigation about habitats within a specified time block(s)	**3. Analyzing and interpreting data (cont.)** ♦ Turn on/off technology in a comparison activity related to plants and/or animals and their habitats within a specified amount of time ♦ Move materials in a comparison activity related to plants and/or animals and their habitats ♦ Use two hands to manipulate materials in a comparison activity related to plants and/or animals and their habitats ♦ Imitate action in a comparison activity related to plants and/or animals and their habitats ♦ Initiate cause and effect response in a comparison activity related to plants and/or animals and their habitats within a specified time block(s) **4. Using mathematics and computational thinking** ♦ Track materials in the creation of a table, chart, or graph about habitats ♦ Orient or manipulate materials in the creation of a table, chart, or graph about habitats ♦ Functionally use materials in the creation of a table, chart, or graph about habitats ♦ Locate material partially hidden or out of sight in the creation of a table, chart, or graph about habitats ♦ Use one object to act on another in the creation of a table, chart, or graph about habitats (e.g., glue stick to adhere materials to graph)	**5. Developing and using models (cont.)** ♦ Use one object to act on another in a model of a habitat (e.g., use a pointer to tap) **6. Constructing explanations** ♦ Orient or manipulate materials related to the creation of a written product to explain habitats **7. Engaging in argument from evidence** ♦ Initiate a cause-and-effect response within a specified amount of time, related to the creation of a written product to support an argument about different plants and animals live in different habitats **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing habitats ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing habitats ♦ Move or functionally use materials to communicate ideas/information representing habitats (e.g., voice output, switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials to communicate ideas/information representing habitats

ACCESS SKILLS to Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Match object to object, or object to picture, or picture to picture of materials to communicate ideas/information representing habitats

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes	**1. Asking questions/defining problems** ♦ Record relevant questions about body parts of animals based on observations ♦ Record relevant questions about parts of plants based on observations ♦ Record relevant questions about how animal parents help their offspring survive based on observations ♦ Record relevant questions about how animals and plants grow and change over time (life cycle) based on observations ♦ Identify questions that can be answered by an investigation about the five senses **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the five senses (e.g., using touch to compare textures, mystery boxes) ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about what plants need to grow and survive ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how plants grow and change over time ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how animals grow and change over time ♦ Record observations (e.g., firsthand experiences, media) to collect data related to what plants need to grow and survive	**3. Analyzing and interpreting data** ♦ Group information/data about how animal parents help their offspring survive (e.g., crying, other vocalizations, feeding, protecting) to identify patterns. ♦ Compare predictions to the data and/or observations from an investigation about how different animals use their senses to survive (e.g., mole vs. mouse, owl vs. hawk) ♦ Compare predictions to the data and/or observations from an investigation about what plants need to grow and survive ♦ Display data using a simple graph or pictures to show how plants grow and change over time ♦ Display data using a simple graph or pictures to show how animals grow and change over time ♦ Group information/data that show how the five senses correspond to the body parts (e.g. ears sense sound, eyes sense light, etc.) **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about how plants grow and change over time ♦ Use counting and numbers to show data about how animals grow and change over time ♦ Use counting and numbers to show data about the five senses	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain how plants grow and change over time ♦ Illustrate, construct, and/or label a model to show/explain how animals grow and change over time ♦ Illustrate, construct, and/or label a model to show/explain the external body parts of animals (e.g., head, eyes, ears, mouth, nose, limbs, etc.) ♦ Illustrate, construct, and/or label a model to show/explain the parts of plants (e.g., roots, stems, leaves, and flowers) ♦ Illustrate, construct, and/or label a model to show/explain how the five senses correspond to body parts (e.g., ears sense sound, eyes sense light, etc.) ♦ Illustrate, construct, and/or label a model to show/explain the functions of the observable parts (e.g., roots, stems, leaves, and flowers) of a plant ♦ Compare a model of the parts of plants (e.g., roots, stems, leaves, and flowers) to the actual object to identify similarities and differences **6. Constructing explanations** ♦ Describe or list how different animals use and take in food, water, and air ♦ Describe or list how animals use their senses to gather information (e.g., sight, sound, smell, taste, touch) ♦ Describe or list how plants grow and change over time

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how different animals use their senses to survive ♦ Use pictures and/or drawings to collect observations related to the external body parts of animals (e.g., head, eyes, ears, mouth, nose, limbs, etc.) ♦ Use pictures and/or drawings to collect observations related to the parts of plants (e.g., roots, stems, leaves, and flowers)	**4. Using mathematics and computational thinking (cont.)** ♦ Identify the qualitative and quantitative information about how plants grow and change over time ♦ Identify the qualitative and quantitative information about how animals grow and change over time	**6. Constructing explanations (cont.)** ♦ Describe or list how animals grow and change over time ♦ Identify observations the match descriptions about how animal parents help their offspring survive (e.g., crying, other vocalizations, feeding, protecting) ♦ Identify observations the match descriptions about the functions of external parts of plants (e.g., roots, stems, leaves, and flowers) ♦ Generate a solution to a problem (e.g., hearing loss, colorblind, loss of mobility) related to sense(s) using pictures or drawings **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how plants and animals grow and change over time ♦ Use scientific evidence in support of an argument about how an offspring's behavior elicits a response from the parent to help them survive (e.g., baby bird in nest chirping with open mouth to request food) **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about how different animals use and take in food, water, and air

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Recall and present information from observations, text, or media source about how animals use their senses to gather information (e.g., sight, sound, smell, taste, touch) ♦ Recall and present information from observations, text, or media source about how plants grow and change over time ♦ Recall and present information from observations, text, or media source about how animals grow and change over time ♦ Communicate scientific information or ideas about the functions of external parts of plants (e.g., roots, stems, leaves, and flowers) ♦ Communicate scientific information or ideas about the use of the five senses to understand the world ♦ Communicate scientific information or ideas about a solution to a problem related to sense(s) (e.g., hearing loss, colorblind, loss of mobility)
Ecosystems: Interact-ions, Energy, and Dynamics	**1. Asking questions/defining problems** ♦ Record relevant questions about plants based on observations on what they need to survive ♦ Record relevant questions about animals based on observations on what they need to survive	**3. Analyzing and interpreting data** ♦ Group information/data about the needs of plants and animals to identify patterns ♦ Group information/data about the specific characteristics that differentiate living from non-living things the needs of plants and animals to identify patterns	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain how plants depend on their surroundings to survive (e.g., food, water, light) ♦ Illustrate, construct, and/or label a model to show/explain how animals depend on their surroundings to survive (e.g., food, water, shelter)

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Record relevant questions about how plants and animals depend on the environment and other living things (disperse seeds, favorable temperature) based on observations ♦ Record relevant questions about living and nonliving things based on observations **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how various shelters are used by animals and/or humans ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how plants and animals depend on the environment and other living things (disperse seeds, favorable temperature) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the basic needs of an animal or plant ♦ Use pictures and/or drawings to collect observations related to living vs. non-living things ♦ Use pictures and/or drawings to collect observations related to how an animal's habitat or home is well-suited to its environment and basic needs (e.g., why birds build nests in trees)	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about how various shelters are used by animals and/or humans ♦ Compare predictions to the data and/or observations from an investigation about how plants and animals depend on the environment and other living things (disperse seeds, favorable temperature) ♦ Display data using a simple graph or pictures to show living and non-living things **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about living and non-living things within the local environment ♦ Identify the qualitative and quantitative information about how plants and animals depend on the environment and other living things (disperse seeds, favorable temperature)	**5. Developing and using models (cont.)** ♦ Illustrate, construct, and/or label a model to show/explain specific characteristics that differentiate living from non-living things the needs of plants and animals ♦ Distinguish between a model and the actual living and/or non-living thing ♦ Compare a model of a living animal or plant to the actual organism to identify similarities and differences ♦ Compare a model of a non-living thing to the actual thing to identify similarities and differences **6. Constructing explanations** ♦ Describe how plants depend on their surroundings to survive (e.g., food, water, light) ♦ Describe how animals depend on their surroundings to survive (e.g., food, water, shelter) ♦ Describe how plants and animals depend on the environment and other living things (disperse seeds, favorable temperature) ♦ Identify observations that match descriptions about non-living and living things ♦ Identify observations that match descriptions about how plants and animals meet their basic needs (e.g., obtain food, air, water, shelter, sunlight)

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interact-ions, Energy, and Dynamics (cont.)			**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that plants need water, food, air, shelter, and sunlight to survive ♦ Use scientific evidence to support a claim regarding the characteristics of living things that distinguish them from non-living things ♦ Use scientific evidence to support a claim regarding how animals meet their needs (water, food, air, favorable temperatures, and shelter) in a local environment **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about how plants depend on their surroundings to survive (e.g., food, water, light) ♦ Recall and present information from observations, text, or media source about how animals depend on their surroundings to survive (e.g., food, water, shelter) ♦ Communicate scientific information or ideas about how plants and animals depend on the environment and other living things (disperse seeds, favorable temperature) ♦ Research, record evidence, and/or present information from various texts to explain how the basic needs of living things are provided by their local environment (e.g., food, air, water, shelter)

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interact-ions, Energy, and Dynamics (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research, record evidence, and/or present examples from the local environment or information from a text showing how plants and animals are dependent on one another (e.g., bees pollinate flowers, birds' nest in trees, giraffes eat leaves)
Heredity: Inheritance and Variation of Traits	**1. Asking questions/defining problems** ♦ Record relevant questions about similarities and differences between young pants and their parents based on observations ♦ Record relevant questions about similarities and differences between young animals and their parents based on observations ♦ Record relevant questions about similarities and differences among different types of plants based on observations ♦ Record relevant questions about similarities and differences among different types of animals based on observations ♦ Record relevant questions about similarities and differences among the same type of plant based on observations ♦ Record relevant questions about similarities and differences among the same type of animal based on observations	**3. Analyzing and interpreting data** ♦ Group information/data about different types of plants to identify patterns. ♦ Group information/data about different types of animals to identify patterns. ♦ Group information/data about similarities and differences between young plants and their parents (e.g., oak tree and sapling) to identify patterns ♦ Group information/data about similarities and differences between young animals and their parents to identify patterns. ♦ Compare predictions to the data and/or observations from an investigation about similarities and differences among different types of plants ♦ Compare predictions to the data and/or observations from an investigation about similarities and differences among different types of animals	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain similarities and differences between young plants and their parents ♦ Illustrate, construct, and/or label a model to show/explain similarities and differences between young animals and their parents **6. Constructing explanations** ♦ Describe how there are similarities and differences among the same type of animal ♦ Describe how there are similarities and differences among the same type of plant ♦ Identify observations that match descriptions about similarities and differences between young plants and their parents ♦ Identify observations that match descriptions about similarities and differences between young animals and their parents ♦ Identify observations that match descriptions about similarities and differences among different types of plants

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about similarities and differences among different types of plants ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about similarities and differences among different types of animals ♦ Record observations (e.g., firsthand experiences, media) to collect data related to similarities and differences among the same type of plant ♦ Record observations (e.g., firsthand experiences, media) to collect data related to similarities and differences among the same type of animal ♦ Use pictures and/or drawings to collect observations related to similarities and differences between young plants and their parents ♦ Use pictures and/or drawings to collect observations related to similarities and differences between young animals and their parents ♦ Use pictures and/or drawings to collect observations related to similarities and differences among the different types of plants ♦ Use pictures and/or drawings to collect observations related to similarities and differences among the different types of animals	**4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about different types of plants ♦ Use counting and numbers to show data about different types of animals ♦ Identify the qualitative and quantitative information about similarities and differences among different types of plants ♦ Identify the qualitative and quantitative information about similarities and differences among different types of animals	**6. Constructing explanations (cont.)** ♦ Identify observations that match descriptions about similarities and differences among different types of animals **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about why there may be similarities and differences among the same type of animal ♦ Use scientific evidence in support of an argument about why there may be similarities and differences among the same type of plant **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about similarities and differences among the same type of animal ♦ Recall and present information from observations, text, or media source about similarities and differences among the same type of plant ♦ Communicate scientific information or ideas about similarities and differences among different types of plants ♦ Communicate scientific information or ideas about similarities and differences among different types of animals

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Recall and present information from observations, text, or media source about similarities and differences among the same type of animal ♦ Recall and present information from observations, text, or media source about similarities and differences among the same type of plant ♦ Communicate scientific information or ideas about similarities and differences among different types of plants ♦ Communicate scientific information or ideas about similarities and differences among different types of animals ♦ Communicate scientific information or ideas about similarities and differences between young plants and their parents ♦ Communicate scientific information or ideas about similarities and differences between young animals and their parents
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ♦ Record relevant questions about habitats based on observations (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Ask relevant questions based on observations about animals living a particular habitat (e.g., rain forest, temperate forest, desert, arctic, ocean)	**3. Analyzing and interpreting data** ♦ Group information/data about animals by habitat to identify patterns. ♦ Group information/data about plants by habitat to identify patterns ♦ Compare predictions to the data and/or observations from an investigation about living things in a local habitat (e.g., school yard)	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain types of plants and animals that are commonly found in a temperate forest in New England (e.g., oak and maple trees, frogs, salamanders, birds, squirrels, rabbits, skunks, deer, fox, bear)

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Ask relevant questions based on observations about plants living a particular habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about living things in a local habitat (e.g., school yard) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to animals living a particular habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to plants living a particular habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Use pictures and/or drawings to collect observations related to different habitats (e.g., rain forest, temperate forest, desert, arctic, ocean)	**3. Analyzing and interpreting data (cont.)** ♦ Display data using a simple graph or pictures to show the kinds of living things in different environments (e.g., rainforest, desert, grassland) ♦ Display data using a simple graph or pictures to show living things in a local habitat (e.g., school yard) **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about living things in a local habitat ♦ Identify the qualitative and quantitative information about living things in a local habitat (e.g., school yard) ♦ Identify the qualitative and quantitative information about specific plants and their specific habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Identify the qualitative and quantitative information about specific animals and their specific habitat (e.g., rain forest, temperate forest, desert, arctic, ocean)	**5. Developing and using models (cont.)** ♦ Illustrate, construct, and/or label a model to show/explain animals and plants living a particular habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Illustrate, construct, and/or label a model to show/explain living things in a local habitat (e.g., school yard) ♦ Illustrate, construct, and/or label a model to show/explain the different kinds of living things in different habitats **6. Constructing explanations** ♦ Describe how different animal and plant things live in specific habitats. ♦ Identify observations the match descriptions about specific plants and their specific habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Identify observations the match descriptions about specific animals and their specific habitat (e.g., rain forest, temperate forest, desert, arctic, ocean) **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about different plants and animals live in different habitats

ENTRY POINTS to
Life Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about living things in a local habitat (e.g., school yard) ♦ Communicate scientific information or ideas about different habitats. ♦ Research, record evidence, and/or present information on plants and their specific habitats (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Research, record evidence, and/or present information on animals and their specific habitats (e.g., rain forest, temperate forest, desert, arctic, ocean) ♦ Research, record evidence, and/or present information on the different kinds of living things in different habitats (e.g., rain forest, temperate forest, desert, arctic, ocean)

Grade Level: Grade 3

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**3-LS1-1**	Use simple graphical representations to show that different types of organisms have unique and diverse life cycles. Describe that all organisms have birth, growth, reproduction, and death in common but there are a variety of ways in which these happen. Clarification Statements: ♦ Examples can include different ways plants and animals begin (e.g., sprout from a seed, born from an egg), grow (e.g., increase in size and weight, produce a new part), reproduce (e.g., develop seeds, root runners, mate and lay eggs that hatch), and die (e.g., length of life). ♦ Plant life cycles should focus on those of flowering plants. ♦ Describing variation in organism life cycles should focus on comparisons of the general stages of each, not specifics.
Heredity: Inheritance and Variation of Traits	**3-LS3-1**	Provide evidence, including through the analysis of data, that plants and animals have traits inherited from parents and that variation of these traits exist in a group of similar organisms. Clarification Statements: ♦ Examples of inherited traits that vary can include the color of fur, shape of leaves, length of legs, and size of flowers. ♦ Focus should be on non-human examples.
	3-LS3-2	Distinguish between inherited characteristics and those characteristics that result from a direct interaction with the environment. Give examples of characteristics of living organisms that are influenced by both inheritance and the environment. Clarification Statements: ♦ Examples of the environment affecting a characteristic could include normally tall plants stunted because they were grown with insufficient water or light, a lizard missing a tail due to a predator, and a pet dog becoming overweight because it is given too much food and little exercise. ♦ Focus should be on non-human examples.
Biological Evolution: Unity and Diversity	**3-LS4-1**	Use fossils to describe types of organisms and their environments that existed long ago and compare those to living organisms and their environments. Recognize that most kinds of plants and animals that once lived on Earth are no longer found anywhere. Clarification Statement: ♦ Comparisons should focus on physical or observable features.

Grade Level: Grade 3

Core Idea	Learning Standards as written	
Biological Evolution: Unity and Diversity (cont.)	**3-LS4-2**	Use evidence to construct an explanation for how the variations in characteristics among individuals within the same species may provide advantages to these individuals in their survival and reproduction. Clarification Statements: ♦ Examples can include rose bushes of the same species, one with slightly longer thorns than the other which may prevent its predation by deer, and color variation within a species that may provide advantages so one organism may be more likely to survive and therefore more likely to produce offspring. ♦ Examples of evidence could include needs and characteristics of the organisms and habitats involved.
	3-LS4-3	Construct an argument with evidence that in a particular environment some organisms can survive well, some survive less well, and some cannot survive. Clarification Statement: ♦ Examples of evidence could include needs and characteristics of the different organisms (species) and habitats involved.
	3-LS4-4	Analyze and interpret given data about changes in a habitat and describe how the changes may affect the ability of organisms that live in that habitat to survive and reproduce. Clarification Statements: ♦ Changes should include changes to landforms, distribution of water, climate, and availability of resources. ♦ Changes in the habitat could range in time from a season to a decade. ♦ While it is understood that ecological changes are complex, the focus should be on a single change to the habitat.
	3-LS4-5(MA)	Provide evidence to support a claim that the survival of a population is dependent upon reproduction.

Grade Level: Grade 4

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**4-LS1-1**	Construct an argument that animals and plants have internal and external structures that support their survival, growth, behavior, and reproduction. Clarification Statements: ♦ Animal structures can include legs, wings, fins, feathers, trunks, claws, horns, antennae, eyes, ears, nose, heart, stomach, lung, brain, and skin. ♦ Plant structures can include leaves, roots, stems, bark, branches, flowers, fruit, and seeds.

Grade Level: Grade 5

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**5-LS1-1**	Ask testable questions about the process by which plants use air, water, and energy from sunlight to produce sugars and plant materials needed for growth and reproduction.
Ecosystems: Interaction, Energy, and Dynamics	**5-LS2-1**	Develop a model to describe the movement of matter among producers, consumers, decomposers, and the air, water, and soil in the environment to (a) show that plants produce sugars and plant materials, (b) show that animals can eat plants and/or other animals for food, and (c) show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. Clarification Statement: ♦ Emphasis is on matter moving throughout the ecosystem.
	5-LS2-2(MA)	Compare at least two designs for a composter to determine which is most likely to encourage decomposition of materials. * Clarification Statement: ♦ Measures or evidence of decomposition should be on qualitative descriptions or comparisons.

ENTRY POINTS to Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about plant structures ♦ Use observations and/or data to ask relevant questions about animal structures ♦ Use observations and/or data to ask relevant questions about the life cycles of animals and plants (birth, growth, reproduction, and death) ♦ Identify questions that can be answered by an investigation about how plants create food from the environment ♦ Identify questions that can be answered by an investigation about the structures of plants that promote survival, growth, and reproduction ♦ Identify questions that can be answered by an investigation about the structures of animals that promote survival, growth, and reproduction **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the effect of sunlight on the growth of plants ♦ Select the best method to collect data and/or observations about the effect of water and/or sunlight on the growth of plants	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about the effect of sunlight on the growth of plants ♦ Use data and/or observations to identify patterns about the effect of sunlight on the growth of plants ♦ Use data and/or observations to identify relationships between animal life cycles ♦ Display data using a simple graph to show the effect of water and/or sunlight on the growth of plants ♦ Draw conclusions based on evidence (e.g., from an investigation) about the effect of sunlight on the growth of plants **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the effect of water and/or sunlight on the growth of plants ♦ Describe, measure, and/or compare quantitative attributes of the effect of water and/or sunlight on the growth of plants	**5. Developing and using models** ♦ Compare models of animal life cycles (birth, growth, reproduction, and death) to identify common features and differences ♦ Compare models of plant life cycles (birth, growth, reproduction, and death) to identify common features and differences ♦ Compare models of animals to identify common structures that promote survival, growth, and reproduction ♦ Illustrate or develop a model to show/explain how animals change throughout their life cycle (birth, growth, reproduction, and death) ♦ Illustrate or develop a model to show/explain how plants change throughout their life cycle (birth, growth, reproduction, and death) ♦ Illustrate or develop a model to show/explain the functions of external plant structures ♦ Illustrate or develop a model to show/explain how plants use air, water, and energy from the sun for growth and reproduction **6. Constructing explanations** ♦ Describe the relationship between plants and sunlight ♦ Describe how specific plant structures support their survival and growth (e.g., leaves, thorns) ♦ Describe how specific animal structures support their survival and growth (e.g., wings, fins) ♦ Describe how plants make their food with the help of sunlight and water

ENTRY POINTS to
Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Select the best method to collect data and/or observations about the different types of life cycles of plants (birth, growth, reproduction, and death) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the structures of plants that promote survival, growth, and reproduction (e.g., leaves, roots, stem, bark, branches, flowers, fruit, seeds), ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the structures of animals that promote survival, growth, and reproduction (e.g., legs, wings, fins, feathers) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the different types of life cycles of animals and/or plants (birth, growth, reproduction, and death)		**6. Constructing explanations (cont.)** ♦ Describe how plants change throughout their life cycle (birth, growth, reproduction, and death) ♦ Describe how animals change throughout their life cycle (birth, growth, reproduction, and death) **7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that the Sun effects the growth of plants ♦ Use scientific evidence to support a claim that all plants and animals undergo life cycles (birth, growth, reproduction, and death) **8. Obtaining, evaluating, and communicating information** ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about plant and animal life cycles (birth, growth, reproduction, and death) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how specific plant structures support their survival and growth (e.g., leaves, thorns) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how specific animal structures support their survival and growth (e.g., wings, fins) ♦ Research and present information about how sunlight is essential to the growth of plants

ENTRY POINTS to
Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about how matter moves through an ecosystem (e.g., food web) ♦ Identify questions that can be answered by an investigation about decomposition (e.g., plant, animal) ♦ Define a simple problem that can be solved related to a composter ♦ Use observations and/or data to ask relevant questions about the decomposition of materials in an ecosystem ♦ Use observations and/or data to ask relevant questions about if living things are either producers, consumers, and/or decomposers **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about decomposition in the environment (dry vs. wet; light vs. dark; enclosed vs. ventilated) ♦ Plan and/or follow the steps of an investigation to collect data about the effectiveness of a composter under different conditions (e.g., size and shape, materials, temperature, moisture level) ♦ Select the best method to collect data and/or observations about designing an composter	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about the effectiveness of a composter under different conditions (e.g., size and shape, materials, temperature, moisture level) ♦ Use data and/or observations to identify relationships between producers, consumers, and/or decomposers ♦ Evaluate data and/or observations from tests of different composter designs to determine if it works as intended. ♦ Draw conclusions based on evidence (e.g., from an investigation) about decomposition in the environment **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about decomposition in the environment ♦ Organize the qualitative and quantitative information about different design features for a composter (e.g., temperature, moisture, aeration) ♦ Organize the qualitative and quantitative information about decomposition in the environment	**5. Developing and using models** ♦ Illustrate or develop a model to show/explain how matter moves through an ecosystem (e.g., food web, identifying living things as producers, consumers, and/or decomposers) ♦ Illustrate or develop a model to show/explain different design features for a composter (e.g., temperature, moisture, aeration) ♦ Illustrate or develop a model to show/explain the role of decomposers in recycling matter from waste and dead organisms back into the ecosystem **6. Constructing explanations** ♦ Use tools and/or materials to build a composter that allows materials to decompose ♦ Draw and/or explain a design solution for a composter design ♦ Generate and/or compare multiple solutions to a problem related to composting ♦ Describe the relationship between producers, consumers, and decomposers ♦ Describe how decomposers (e.g., fungi and bacteria) recycle some material back into the air and soil ♦ Describe the characteristics of producers, consumers, and decomposers

ENTRY POINTS to Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations (e.g., firsthand experiences, media) to collect data related to organisms in an ecosystem as producers, consumers, and/or decomposers		**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim either for or against different design features of a composter (e.g., a closed versus open compost bin) ♦ Use scientific evidence to support a claim about the conditions necessary for rapid decomposition within a ecosystem **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about different composter designs ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the movement of matter in an ecosystem (e.g., food web) ♦ Research and present information about the most effective design for a composter that encourages the process of decomposition ♦ Research and present information about different composter designs
Heredity: Inheritance and Variation of Traits	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about inherited traits of plants ♦ Use observations and/or data to ask relevant questions about inherited traits of animals	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about the characteristics of organisms that are a result of the environment	**5. Developing and using models** ♦ Illustrate or develop a model to show/explain the inherited traits of plants ♦ Illustrate or develop a model to show/explain the inherited traits of animals ♦ Illustrate or develop a model to show/explain that variation of traits can exist among animals of the same species

ENTRY POINTS to Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Use observations and/or data to ask relevant questions about variations in the characteristics of the same animal (e.g., fur color, size of ears) ♦ Use observations and/or data to ask relevant questions about variations in the characteristics of the same plant (e.g., flower color, leaf shape) ♦ Use observations and/or data to ask relevant questions about characteristics of organisms that are the result of inheritance and those that are a result of the environment (e.g., stunted plant growth) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data about characteristics of organisms that are a result of the environment ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about characteristics of organisms that are the result of inheritance ♦ Record observations (e.g., firsthand experiences, media) to collect data related to inherited traits of plants ♦ Record observations (e.g., firsthand experiences, media) to collect data related to inherited traits of animals	**3. Analyzing and interpreting data (cont.)** ♦ Compare predictions to the data and/or observations from an investigation about the characteristics of organisms that are the result of inheritance ♦ Display data using a simple graph to show inherited traits of plants ♦ Display data using a simple graph to show inherited traits of animals ♦ Draw conclusions based on evidence (e.g., from an investigation) about animal and/or plant characteristics that are inherited versus those resulting from interaction with the environment **4. Using mathematics and computational thinking** ♦ Organize the qualitative and quantitative information about variation of traits that exist among animals of the same species ♦ Organize the qualitative and quantitative information about the variation of traits that exist among plants of the same species	**5. Developing and using models (cont.)** ♦ Illustrate or develop a model to show/explain characteristics of organisms that are a result of the environment **6. Constructing explanations** ♦ Describe how inherited traits (e.g., fur color, size of flowers) of a plant and/or animal offspring are characteristics of each parent ♦ Describe the relationship between how a characteristic is a result of both inheritance and being influenced by the environment. ♦ Describe variations in the traits and characteristics of offspring within the same species **7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that certain characteristics of plants and/or animals are affected by their environment while others are inherited **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about how plants and/or animals are affected by their environment while others are inherited ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about inherited traits of plants

ENTRY POINTS to
Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about inherited traits of animals ♦ Research and present information about groups of organisms from the same species share similar characteristics, but with some variation among individuals (e.g., litter of kittens) ♦ Research and present information about characteristics of organisms that are a result of the environment (e.g., stunted growth)
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about the features of animals that help them survive (e.g., sense of smell, thick fur, large ears) ♦ Use observations and/or data to ask relevant questions about the features of plants that help them survive (e.g., different shaped leaves, spikes) ♦ Use observations and/or data to ask relevant questions about the changes in the environment that affect the survival of plants ♦ Use observations and/or data to ask relevant questions about the changes in the environment that affect the survival of animals	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about variations in characteristics among animals of the same kind that provide advantages to help them survive and reproduce (e.g., color variation of rabbits within same species that provide advantages to survive) ♦ Compare predictions to the data and/or observations from an investigation about variations in characteristics among plants of the same kind that provide advantages to help them survive and reproduce (e.g., rose bushes of the same species, one with slightly longer thorns than other might prevent predation)	**5. Developing and using models** ♦ Distinguish between a model of a fossil and the actual fossil ♦ Compare models of fossils and living organisms to identify common features and differences. ♦ Illustrate or develop a model to show/explain an animal and the characteristics that help them to survive ♦ Illustrate or develop a model to show/explain a plant and the characteristics that help them to survive ♦ Illustrate or develop a model to show/explain how seasonal behaviors (e.g., leaf loss, migration, hibernation, and storing food) help plants or animals survive environmental changes

ENTRY POINTS to Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Use observations and/or data to ask relevant questions about how some organisms can survive in some environments and not in others ♦ Use observations and/or data to ask relevant questions about a how a plant or animal will be affected by an environmental change (e.g., drought, fire, loss of habitat or food) ♦ Identify questions that can be answered by an investigation about variations in characteristics among plants of the same kind that provide advantages to help them survive and reproduce (e.g., rose bushes of the same species, one with slightly longer thorns than other might prevent predation) ♦ Identify questions that can be answered by an investigation about variations in characteristics among animals of the same kind that provide advantages to help them survive and reproduce (e.g., color variation of rabbits within same species that provide advantages to survive) ♦ Use observations and/or data to ask relevant questions about fossils. ♦ Use observations and/or data to ask relevant questions about how survival of a population is dependent upon reproduction (e.g., endangered species)	**3. Analyzing and interpreting data (cont.)** ♦ Compare predictions to the data and/or observations from an investigation about fossils and past environments (e.g., shark tooth found in a mountain side) ♦ Use data and/or observations to identify relationships between a plant or animal and an environmental change (e.g., drought, fire, flood, loss of habitat or food) ♦ Use data and/or observations to identify relationships between fossils and past environments (e.g., shark tooth found in a mountain side) ♦ Display data using a simple graph to show variations in characteristics among plants of the same kind that provide advantages to help them survive and reproduce (e.g., rose bushes of the same species, one with slightly longer thorns than other might prevent predation) ♦ Display data using a simple graph to show about variations in characteristics among animals of the same kind that provide advantages to help them survive and reproduce (e.g., color variation of rabbits within same species that provide advantages to survive)	**6. Constructing explanations** ♦ Describe how seasonal behaviors (e.g., leaf loss, migration, hibernation, and storing food) help plants or animals survive environmental changes ♦ Describe how the environment of a plant impacts its ability to survive. ♦ Describe how the environment of an animal impacts its ability to survive. ♦ Explain how different types of plants that once existed throughout Earth's history are now extinct. ♦ Explain how different types of animals that once existed throughout Earth's history are now extinct ♦ Explain how about variations in characteristics among animals of the same kind that provide advantages to help them survive and reproduce (e.g., color variation of rabbits within same species that provide advantages to survive) ♦ Explain how variations in characteristics among plants of the same kind that provide advantages to help them survive and reproduce (e.g., rose bushes of the same species, one with slightly longer thorns than other might prevent predation) ♦ Explain how fossils provide evidence for plants or animals that once existed throughout Earth's history are now extinct ♦ Describe similarities and differences between fossils and present-day organisms ♦ Describe the survival of a plant or animal population

ENTRY POINTS to
Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Use observations and/or data to ask relevant questions about how fossils are used to identify types of organisms and their environments that existed long ago ♦ Use observations and/or data to ask relevant questions comparing fossils to living organisms and their environments ♦ Use observations and/or data to ask relevant questions about how seasonal behaviors (e.g., leaf loss, migration, hibernation, and storing food) help plants or animals survive environmental changes **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about fossils and past environments (e.g., shark tooth found on a mountain side) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to fossils (physical and observable features) ♦ Select the best method to collect data and/or observations about animal adaptions ♦ Select the best method to collect data and/or observations about plant adaptions	**3. Analyzing and interpreting data (cont.)** ♦ Draw conclusions based on evidence (e.g., from an investigation) about features of animals that enable them to survive in their habitat (e.g., thick fur in a cold climate, webbed feet in frogs, protective coloration) ♦ Draw conclusions based on evidence (e.g., from an investigation) about features of plants that enable them to survive in their habitat (e.g., waxy leaves to repel water in wet climates, long roots to find water in dry climates) ♦ Draw conclusions based on evidence (e.g., from an investigation) about plants and/or animals that lived long ago, but no longer exist **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about fossils and past environments (e.g., number of wooly mammoths found in an area ♦ Organize the qualitative and quantitative information about fossils and past environments ♦ Organize the qualitative and quantitative information about features of animals that enable them to survive in their habitat (e.g., thick fur in a cold climate, webbed feet in frogs, protective coloration)	**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that changes in the environment impact the survival of plants or animals ♦ Use scientific evidence to support a claim that fossils provide evidence for plants or animals that once existed throughout Earth's history are now extinct. ♦ Use scientific evidence to support a claim that the survival of a population is dependent upon reproduction (e.g., endangered species) **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about a how a plant or animal will be affected by an environmental change (e.g., drought, fire, loss of habitat or food) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how changes in the environment affect the survival of plants ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how changes in the environment affect the survival of animals ♦ Research and present information about features of animals that help them survive (e.g., sense of smell, thick fur, large ears)

ENTRY POINTS to
Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations (e.g., firsthand experiences, media) to collect data related to features of animals that enable them to survive in their habitat (e.g., thick fur in a cold climate, webbed feet in frogs, protective coloration) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to features of plants that enable them to survive in their habitat (e.g., waxy leaves to repel water in wet climates, long roots to find water in dry climates) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to about how the survival of a population is dependent upon reproduction (e.g., endangered species) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how plants or animals will be affected by an environmental change (e.g., drought, fire, flood, loss of habitat or food) ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about variations in characteristics among plants of the same kind that provide advantages to help them survive and reproduce (e.g., rose bushes of the same species, one with slightly longer thorns than other might prevent predation)	**4. Using mathematics and computational thinking (cont.)** ♦ Organize the qualitative and quantitative information about features of plants that enable them to survive in their habitat (e.g., waxy leaves to repel water in wet climates, long roots to find water in dry climates) ♦ Organize the qualitative and quantitative information about plants or animals will be affected by an environmental change (e.g., drought, fire, flood, loss of habitat or food)	**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research and present information about features of plants that help them survive (e.g., different shaped leaves, spikes) ♦ Research, record evidence, and/or present information on the relationship between reproduction and the survival of a species ♦ Research, record evidence, and/or present information the environmental conditions that existed long ago that enabled different plants and animals to exist ♦ Research, record evidence, and/or present information about variations in characteristics among plants of the same kind that provide advantages to help them survive and reproduce (e.g., rose bushes of the same species, one with slightly longer thorns than other might prevent predation) ♦ Research, record evidence, and/or present information about variations in characteristics among animals of the same kind that provide advantages to help them survive and reproduce (e.g., color variation of rabbits within same species that provide advantages to survive) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how fossils are used to identify types of organisms and their environments that existed long ago

ENTRY POINTS to
Life Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) comparing fossils to living organisms and their environments upon reproduction (e.g., endangered species) ♦ Research, record evidence, and/or present information about how survival of a population is dependent ♦ Research, record evidence, and/or present information about how seasonal behaviors (e.g., leaf loss, migration, hibernation, and storing food) help plants or animals survive environmental changes

Grade Level: Grade 6

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**6.MS-LS1-1**	Provide evidence that all organisms (unicellular and multicellular) are made of cells. Clarification Statement: ♦ Evidence can be drawn from multiple types of organisms, such as plants, animals, and bacteria.
	6.MS-LS1-2	Develop and use a model to describe how parts of cells contribute to the cellular functions of obtaining food, water, and other nutrients from its environment, disposing of wastes, and providing energy for cellular processes. Clarification Statement: ♦ Parts of plant and animal cells include (a) the nucleus, which contains a cell's genetic material and regulates its activities; (b) chloroplasts, which produce necessary food (sugar) and oxygen through photosynthesis (in plants); (c) mitochondria, which release energy from food through cellular respiration; (d) vacuoles, which store materials, including water, nutrients, and waste; (e) the cell membrane, which is a selective barrier that enables nutrients to enter the cell and wastes to be expelled; and (f) the cell wall, which provides structural support (in plants).
	6.MS-LS1-3	Construct an argument supported by evidence that the body systems interact to carry out essential functions of life. Clarification Statements: ♦ Emphasis is on the functions and interactions of the body systems, not specific body parts or organs. ♦ An argument should convey that different types of cells can join together to form specialized tissues, which in turn may form organs that work together as body systems. ♦ Body systems to be included are the circulatory, digestive, respiratory, excretory, muscular/skeletal, and nervous systems. ♦ Essential functions of life include obtaining food and other nutrients (water, oxygen, minerals), releasing energy from food, removing wastes, responding to stimuli, maintaining internal conditions, and growing/developing. ♦ An example of interacting systems could include the respiratory system taking in oxygen from the environment which the circulatory system delivers to cells for cellular respiration, or the digestive system taking in nutrients which the circulatory system transports to cells around the body.

Grade Level: Grade 6

Core Idea	Learning Standards as written	
Biological Evolution: Unity and Diversity **Biological Evolution: Unity and Diversity**	**6.MS-LS4-1**	Analyze and interpret evidence from the fossil record to describe organisms and their environment, extinctions, and changes to life forms throughout the history of Earth. Clarification Statement: ♦ Examples of evidence include sets of fossils that indicate a specific type of environment, anatomical structures that indicate the function of an organism in the environment, and fossilized tracks that indicate behavior of organisms.
	6.MS-LS4-2	Construct an argument using anatomical structures to support evolutionary relationships among and between fossil organisms and modern organisms. Clarification Statement: ♦ Evolutionary relationships include (a) some organisms have similar traits with similar functions because they were inherited from a common ancestor, (b) some organisms have similar traits that serve similar functions because they live in similar environments, and (c) some organisms have traits inherited from common ancestors that no longer serve their original function because their environments are different than their ancestors' environments.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**7.MS-LS1-4**	Construct an explanation based on evidence for how characteristic animal behaviors and specialized plant structures increase the probability of successful reproduction of animals and plants. Clarification Statements: ♦ Examples of animal behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalizations and colorful plumage to attract mates for breeding. ♦ Examples of animal behaviors that affect the probability of plant reproduction could include (a) transferring pollen or seeds and (b) creating conditions for seed germination and growth. ♦ Examples of plant structures that affect the probability of plant reproduction could include bright flowers attracting butterflies that transfer pollen, flower nectar, and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.
Ecosystems: Inter-actions, Energy, and Dynamics	**7.MS-LS2-1**	Analyze and interpret data to provide evidence for the effects of periods of abundant and scarce resources on the growth of organisms and the size of populations in an ecosystem.
	7.MS-LS2-2	Describe how relationships among and between organisms in an ecosystem can be competitive, predatory, parasitic, and mutually beneficial and that these interactions are found across multiple ecosystems. Clarification Statement: ♦ Emphasis is on describing consistent patterns of interactions in different ecosystems in terms of relationships among and between organisms.
	7.MS-LS2-3	Develop a model to describe that matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes. Clarification Statements: ♦ Cycling of matter should include the role of photosynthesis, cellular respiration, and decomposition, as well as transfer among producers, consumers (primary, secondary, and tertiary), and decomposers. ♦ Models may include food webs and food chains.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
Ecosystems: Inter-actions, Energy, and Dynamics (cont.)	**7.MS-LS2-4**	Analyze data to provide evidence that disruptions (natural or human-made) to any physical or biological component of an ecosystem can lead to shifts in all its populations. Clarification Statement: ♦ Focus should be on ecosystem characteristics varying over time, including disruptions such as hurricanes, floods, wildfires, oil spills, and construction.
	7.MS-LS2-5	Evaluate competing design solutions for protecting an ecosystem. Discuss benefits and limitations of each design. * Clarification Statements: ♦ Examples of design solutions could include water, land, and species protection and the prevention of soil erosion. ♦ Examples of design solution constraints could include scientific, economic, and social considerations.
	7.MS-LS2-6(MA)	Explain how changes to the biodiversity of an ecosystem—the variety of species found in the ecosystem—may limit the availability of resources humans use. Clarification Statement: ♦ Examples of resources can include food, energy, medicine, and clean water.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes	**8.MS-LS1-5**	Construct an argument based on evidence for how environmental and genetic factors influence the growth of organisms. Clarification Statements: ♦ Examples of environmental conditions could include availability of food, light, space, and water. ♦ Examples of genetic factors could include the genes responsible for size differences in different breeds of dogs, such as Great Danes and Chihuahuas. ♦ Examples of environmental factors could include drought decreasing plant growth, fertilizer increasing plant growth, and fish growing larger in large ponds than they do in small ponds. ♦ Examples of both genetic and environmental factors could include different varieties of plants growing at different rates in different conditions.
	8.MS-LS1-7	Use informational text to describe that food molecules, including carbohydrates, proteins, and fats, are broken down and rearranged through chemical reactions forming new molecules that support cell growth and/or release of energy.
Heredity: Inheritance and Variation of Traits	**8.MS-LS3-1**	Develop and use a model to describe that structural changes to genes (mutations) may or may not result in changes to proteins, and if there are changes to proteins there may be harmful, beneficial, or neutral changes to traits. Clarification Statements: ♦ An example of a beneficial change to the organism may be a strain of bacteria becoming resistant to an antibiotic. ♦ A harmful change could be the development of cancer; a neutral change may change the hair color of an organism with no direct consequence.
	8.MS-LS3-2	Construct an argument based on evidence for how asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. Compare/contrast advantages and disadvantages of asexual and sexual reproduction. Clarification Statements: ♦ Examples of an advantage of sexual reproduction can include genetic variation when the environment changes or a disease is introduced, while examples of an advantage of asexual reproduction can include not using energy to find a mate and fast reproduction rates. ♦ Examples of a disadvantage of sexual reproduction can include using resources to find a mate, while a disadvantage in asexual reproduction can be the lack of genetic variation when the environment changes or a disease is introduced.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
Heredity: Inheritance and Variation of Traits (cont.)	**8.MS-LS3-4(MA)**	Develop and use a model to show that sexually reproducing organisms have two of each chromosome in their cell nuclei, and hence two variants (alleles) of each gene that can be the same or different from each other, with one random assortment of each chromosome passed down to offspring from both parents. Clarification Statement: ♦ Examples of models can include Punnett squares, diagrams (e.g., simple pedigrees), and simulations.
Biological Evolution: Unity and Diversity Biological Evolution: Unity and Diversity	**8.MS-LS4-4**	Use a model to describe the process of natural selection, in which genetic variations of some traits in a population increase some individuals' likelihood of surviving and reproducing in a changing environment. Provide evidence that natural selection occurs over many generations. Clarification Statements: ♦ The model should include simple probability statements and proportional reasoning. ♦ Examples of evidence can include Darwin's finches, necks of giraffes, and peppered moths.
	8.MS-LS4-5	Synthesize and communicate information about artificial selection, or the ways in which humans have changed the inheritance of desired traits in organisms. Clarification Statement: ♦ Emphasis is on the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, and gene therapy).

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in an investigation about body systems (e.g., part of a body system was removed or changed) ♦ Ask questions about what would happen if a variable was changed in the environment that impacts the growth of an organism (e.g., availability of food, light, space) ♦ Ask questions about what would happen if a genetic factor was changed that impacts the growth of an organism (e.g., different breeds of dogs) ♦ Identify scientific (testable) and non-scientific (non-testable) questions about body systems and how they interact to carry out essential functions ♦ Identify scientific (testable) and non-scientific (non-testable) questions about how food molecules are broken down and rearranged ♦ Generate scientific questions about the organs of a body system work together to enable the organism to carry out essential life functions based on research and/or observations ♦ Generate scientific questions about plant and/or animal cells based on research and/or observations ♦ Generate scientific questions about the structures of plants that increase the probability of reproduction based on research and/or observations (e.g., bright flowers attracting butterflies, hard shells on seeds)	**3. Analyzing and interpreting data** ♦ Use observations and/or data from an investigation to determine the functions of specialized reproductive structures in plants (e.g., flowers, pollen, seeds) ♦ Use observations and/or data from an investigation to determine the role of animal behavior in reproduction (e.g., display of colorful plumage to attract mates, vocalization) ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the environmental factors that affect plant growth ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about genetic factors that affect organism growth ♦ Compare and contrast data showing how food molecules are broken down and rearranged to support cell growth and/or release of energy ♦ Compare and contrast data showing the functions of plant and animal cells **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about environmental factors that impact plant growth ♦ Organize simple data sets to reveal patterns about genetic factors that impact plant or animal growth	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain the major body systems ♦ Develop, revise, and/or use a model to show/explain how the major body systems interact ♦ Develop, revise, and/or use a model to show/explain the functions of plant and/or animal cells ♦ Develop, revise, and/or use a model to show/explain how food molecules are broken down and rearranged to support cell growth and/or release of energy ♦ Develop, revise, and/or use a model to show/explain that organisms are unicellular or multicellular (e.g., plants, animals, bacteria) **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about plant and animal cells ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how food molecules are broken down and rearranged ♦ Explain the relationships between the major body systems ♦ Explain the relationships between the functions of major organelles in plant cells ♦ Explain the relationships between the functions of major organelles in animal cells

ENTRY POINTS to Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Generate scientific questions about animal behavior that increase the probability of reproduction based on research and/or observations (e.g., display of colorful plumage to attract mates, vocalization) ♦ Generate scientific questions about the functions of the parts of a cell based on research and/or observations ♦ Use observations and/or data to ask relevant questions about genetic and environmental factors that influence the growth of organisms **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about environmental factors that affect plant growth (e.g., sunlight, water, soil nutrients) to produce data/observations to serve as evidence ♦ Plan and/or conduct an investigation about genetic factors that affect organism growth (e.g., size/color of plants or different breeds of dogs) ♦ Plan and/or conduct an investigation about the functions of specialized reproductive structures in plants (e.g., flowers, pollen, seeds ♦ Plan and/or conduct an investigation about the interaction of functions between body systems (e.g., digestive system breaks down food and circulatory systems moves cells containing energy through the body)	**4. Using mathematics and computational thinking (cont.)** ♦ Organize simple data sets to reveal patterns about food molecules to include carbohydrates, fats, and proteins (e.g., compare food labels) ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data about the probability of successful reproduction of animals and/or plants (e.g., probability of colorful plants being pollinated by insects)	**6. Constructing explanations (cont.)** ♦ Explain the relationships between the role of animal behavior in the reproduction of animals and plants (e.g., bees transfer pollen) ♦ Explain the relationships between the role of plant structures in the reproduction of animals and plants (e.g., trees provide stable structure for birds to build nest) ♦ Explain the primary components of food molecules (i.e., carbohydrates, fats, and proteins) ♦ Explain the functions of cell parts ♦ Explain the relationship between environmental factors and organism growth ♦ Explain the relationship between genetic factors and organism growth **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument that all organisms are made up of cells ♦ Use scientific evidence and observations to construct an argument that body systems interact to carry out essential life functions (e.g., respiratory and circulatory systems work together to provide oxygen to cells ♦ Use scientific evidence and observations to construct an argument for how environmental factors influence organism growth ♦ Use scientific evidence and observations to construct an argument for how genetic factors influence organism growth ♦

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Plan and/or conduct an investigation about how food molecules are broken down and rearranged to support cell growth and/or release of energy ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the functions of cell parts (e.g., cell membrane as barrier, mitochondria release energy) ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the functions of specialized reproductive structures in plants (e.g., flowers, pollen, seeds ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the functions of the primary body systems (e.g., digestive, circulatory, respiratory, excretory, nervous, muscular/skeletal) ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the role of animal behavior in reproduction (e.g., display of colorful plumage to attract mates, vocalization)		**8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain how environmental factors influence organism growth ♦ Combine scientific information from multiple sources to explain how genetic factors influence organism growth ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how the body's systems interact ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how food molecules are broken down and rearranged to support cell growth and/or release of energy ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the functions of major organelles in plant cells ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the functions of major organelles in animal cells ♦ Research and record information explaining how the body's systems interact ♦ Research and record information explaining the role of animal behavior in the reproduction of animals and plants ♦ Research and record information explaining the role of animal behavior in the role of plant structures in the reproduction of animals and plants

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable (e.g., population, natural disaster) was changed in an ecosystem ♦ Ask questions about what would happen if a resource (e.g., food, shelter, water) was changed within a population of an ecosystem ♦ Use prior knowledge to describe problems that can be solved using design solutions to protect an ecosystem ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a problem related to the protection of an ecosystem ♦ Generate scientific questions about how the changes to the biodiversity of an ecosystem impact the availability of resources to humans based on research and/or observations ♦ Generate scientific questions about different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem based on research and/or observations ♦ Generate scientific questions about producers, consumers, and decomposers based on research and/or observations ♦ Generate scientific questions about how matter and energy is transferred through an ecosystem based on research and/or observations (e.g., food webs)	**3. Analyzing and interpreting data** ♦ Use observations and/or data from an investigation to determine different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the change in resources (e.g., abundance or scarcity of food, shelter, or water) within a population of an ecosystem ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the changes in population size that result from natural or human made disruptions ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the biodiversity of different ecosystems ♦ Analyze and interpret data to make sense of photosynthesis ♦ Analyze and interpret data to make sense of matter and energy ♦ Analyze and interpret data to make sense of factors that can affect population size within an ecosystem (e.g., abundant or scarce resources) ♦ Compare and contrast data showing how changes in one part of an ecosystem affect other parts of the ecosystem	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain photosynthesis ♦ Develop, revise, and/or use a model to show/explain how matter and energy are transferred within an ecosystem ♦ Develop, revise, and/or use a model to show/explain how changes in one part of an ecosystem affect other parts of the ecosystem ♦ Develop, revise, and/or use a model to show/explain the feeding relationships in a food web (i.e., an interconnected food chain) ♦ Develop, revise, and/or use a model to show/explain different ecosystems ♦ Develop, revise, and/or use a model to show/explain the different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ♦ Develop, revise, and/or use a model to show/explain the disruptions (e.g., natural or human made) on an ecosystem ♦ Develop, revise, and/or use a model to show/explain design solutions to protect an ecosystem **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence about how changes in one part of an ecosystem (e.g., resources, predation, competition, disruptions) affect other parts of the ecosystem

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Generate scientific questions about photosynthesis based on research and/or observations ♦ Generate scientific questions about the biodiversity of an ecosystem based on research and/or observations **2. Planning and carrying out investigations (cont.)** ♦ Plan and/or conduct an investigation about cellular respiration to produce data/observations to serve as evidence about photosynthesis ♦ Plan and/or conduct an investigation about decomposition to produce data/observations to serve as evidence about the cycling of matter ♦ Plan and/or conduct an investigation about the disruptions (e.g., natural or human made) on an ecosystem to produce data/observations to serve as evidence about the effectiveness of a design solution ♦ Plan and/or conduct a simulation about the change in resources (e.g., abundance or scarcity of food, shelter, or water) within a population of an ecosystem to produce data/observations to serve as evidence about its impact on that ecosystem ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about photosynthesis	**3. Analyzing and interpreting data (cont.)** ♦ Compare and contrast data showing the biodiversity of different ecosystems ♦ Use observations and/or data to evaluate and/or refine design solutions to protect an ecosystem **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the biodiversity of different ecosystems ♦ Organize simple data sets to reveal patterns about the disruptions (e.g., natural or human made) on an ecosystem ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) about how a population size changes over a period of time in an ecosystem	**6. Constructing explanations (cont.)** ♦ Draw conclusions based on multiple pieces of evidence about how changes in a population of an ecosystem impacts the ecosystem ♦ Generate and compare multiple solutions to a problem related to protecting an ecosystem ♦ Use observations and data from investigations to design a solution to a problem related to protecting an ecosystem ♦ Explain the transfer of energy and matter in an ecosystem (e.g., photosynthesis, cellular respiration, and decomposition) ♦ Explain the role of producers, consumers, and decomposers in an ecosystem ♦ Explain the different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ♦ Describe how energy from the sun is converted by plants into food (photosynthesis) **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about how a plant or animal helps or harms other organisms in its ecosystem ♦ Use scientific evidence and observations to construct an argument about how biodiversity within an ecosystem is beneficial to humans ♦ Compare and critique two different design solutions to protect an ecosystem

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Select and use appropriate methods and/or tools for collecting data in an investigation the changes to the biodiversity of an ecosystem ♦ Record observations and/or measurements to produce data to serve as evidence for different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ♦ Test two different models of the same proposed design solution to protect an ecosystem to determine which better meets criteria for success		**7. Engaging in argument from evidence (cont.)** ♦ Defend a claim about the merit of a design solution to protect an ecosystem by citing relevant evidence **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain the transfer of energy and matter in an ecosystem (e.g., photosynthesis, cellular respiration, and decomposition) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about design solutions to protect an ecosystem ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how biodiversity within an ecosystem is beneficial to humans ♦ Research, record and/or present information describing the biodiversity of different ecosystems ♦ Research, record and/or present information about protecting an ecosystem ♦ Research, record and/or present information about different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ♦ Research, record and/or present information about feeding relationships in a food web (i.e., an interconnected food chain) ♦ Research, record and/or present information about the disruptions (e.g., natural or human made) on an ecosystem

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits	**1. Asking questions/defining problems** ♦ Generate scientific questions about the structural changes to genes (mutations) based on research and/or observations ♦ Generate scientific questions about the changes to proteins that could occur from a mutation based on research and/or observations ♦ Generate scientific questions about asexual and sexual reproduction based on research and/or observations ♦ Generate scientific questions about how traits are passed down to offspring based on research and/or observations ♦ Generate scientific questions about dominant and recessive inherited traits based on research and/or observations	**3. Analyzing and interpreting data** ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about dominant and recessive inherited traits ♦ Compare and contrast data showing the probability of a trait being inherited after observing a parent organism and its offspring ♦ Compare and contrast data showing organisms that reproduce sexually and those that reproduce asexually based on descriptions of different organisms ♦ Compare and contrast data showing the probability of inheriting a particular trait using a Punnett square **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about changes to proteins (e.g. harmful, beneficial, neutral) that affect an organism ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about data on classmates' inherited traits ♦ Apply mathematical concepts and/or processes (ratios, percentages, proportions, and/or basic operations) to determine the probability of inheriting a particular trait using a Punnett square	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain how asexual reproduction produces offspring with identical genetic information ♦ Develop, revise, and/or use a model to show/explain how sexual reproduction produces offspring with genetic variations ♦ Develop, revise, and/or use a model to show/explain how different traits are passed down to offspring: one allele from the mother and one allele from the father (e.g. Punnett squares, simple pedigrees) ♦ Develop, revise, and/or use a model to show/explain the changes to proteins (e.g. harmful, beneficial, neutral) that can affect an organism **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence about the advantages and disadvantages of sexual and asexual reproduction ♦ Explain how alleles represent different forms of the same gene ♦ Explain how the changes to proteins (e.g. harmful, beneficial, neutral) that can affect an organism **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about which traits that are more or less likely to appear in offspring (e.g., are dominant or recessive)

ENTRY POINTS to Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about inherited traits (e.g., eye color, widow's peak, rolled tongue, dimples) to produce data/observations to serve as evidence ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about organisms that reproduce sexually and those that reproduce asexually ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the changes to proteins (e.g. harmful, beneficial, neutral) that affect an organism		**7. Engaging in argument from evidence (cont.)** ♦ Compare and critique two arguments about the probability of offspring inheriting a specific trait using evidence from a Punnett square **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain the difference between asexual and sexual reproduction ♦ Combine scientific information from multiple sources to explain how the changes to proteins (e.g. harmful, beneficial, neutral) can affect an organism ♦ Research, record evidence, and/or present information on a genetic cross by summarizing the results of a Punnett square ♦ Research, record, and/or present a summary of a survey of classmates' inherited traits (e.g., hair color, left- vs. right-handedness, freckles, shape of ears)
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ♦ Ask questions how artificial selection is used to create a genetic modification in plants and/or animals (e.g., seedless watermelon, dogs) ♦ Asks questions about what would happen to a plant or animal in a population with a certain trait (e.g., peppered moths) following an environmental change	**3. Analyzing and interpreting data** ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about how organisms became extinct ♦ Analyze and interpret data to make sense of the process of natural selection in a plant or animal population	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain the similarity in the limb structures of mammals ♦ Develop, revise, and/or use a model to show/explain the process of natural selection in a population

ENTRY POINTS to Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**1. Asking questions/defining problems** ♦ Generate scientific questions about how organisms have changed throughout the history of Earth (e.g. fossil record) based on research and/or observations ♦ Generate scientific questions about the evolutionary relationships between fossil organisms and modern organisms based on research and/or observations ♦ Generate scientific questions about the process of natural selection in a plant or animal population based on research and/or observations (e.g. Darwin's finches, necks of giraffes, peppered moths) **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation (e.g. computer simulation) about artificial selection (e.g., genetic modification, animal husbandry, gene therapy) to produce data/observations to serve as evidence ♦ Plan and/or conduct an investigation (e.g. computer simulation) about natural selection in a plant or animal population to produce data/observations to serve as evidence ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about how organisms became extinct (e.g., simulations)	**3. Analyzing and interpreting data** ♦ Analyze and interpret data to make sense of the fossil record (e.g. mass extinctions, emergence of new species or characteristics that increased survival, changes to the environment) ♦ Compare and contrast data showing different technologies used for artificial selection (e.g., genetic modification, animal husbandry, gene therapy) ♦ Compare and contrast data showing structures (e.g., wing structure on a species of bird; shapes of leaves on a plant) that occur due to common ancestry vs. those that arise from shared environments ♦ Compare and contrast data showing evolutionary relationships between fossil organisms and modern organisms **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about natural selection in a plant or animal population ♦ Organize simple data sets to reveal patterns about artificial selection in plants and animals ♦ Organize simple data sets to reveal patterns about evolutionary relationships between fossil organisms and modern organisms ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about natural selection in a plant or animal population	**5. Developing and using models (cont.)** ♦ Develop, revise, and/or use a model to show/explain the evolutionary relationships between fossil organisms and modern organisms ♦ Develop, revise, and/or use a model to show/explain how organisms became extinct **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about process of natural selection in a plant or animal population ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how organisms became extinct ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about the fossil record (e.g. mass extinctions, emergence of new species or characteristics that increased survival, changes to the environment ♦ Describe how modern organisms are similar to their extinct ancestors (e.g., woolly mammoth and elephant) ♦ Explain the relationship between fossil organisms and modern organisms ♦ Explain how the different technologies are used for artificial selection (e.g., genetic modification, animal husbandry, gene therapy) ♦ Explain how changing environmental pressures have caused the traits of organisms to change over time due to natural selection

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**2. Planning and carrying out investigations** ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about evolutionary relationships between fossil organisms and modern organisms ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the fossil record compared to historical temperature graphs to identify periods of extreme conditions (e.g. ice ages)	**4. Using mathematics and computational thinking (cont.)** ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about artificial selection in plants and animals	**6. Constructing explanations (cont.)** ♦ Explain how organisms have changed over time by identifying the differences between modern organisms and their ancestors ♦ Explain the differences between natural selection and artificial selection **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about how natural selection takes place over many generations ♦ Compare and critique two arguments about how a specific organism became extinct ♦ Use scientific evidence and observations to construct an argument about the common ancestry of certain plants and/or animals **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain the different technologies used for artificial selection (e.g., genetic modification, animal husbandry, gene therapy) ♦ Combine scientific information from multiple sources to explain the evolutionary relationships between fossil organisms and modern organisms ♦ Research, record evidence, and/or present information on the evolutionary relationships between fossil organisms and modern organisms

ENTRY POINTS to
Life Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how organisms became extinct ♦ Research, record evidence, and/or present information on the process of natural selection ♦ Research, record evidence, and/or present information on how mass extinctions, emergence of new species or characteristics that increased survival, and/or changes to the environment are documented in fossil records ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about differences between natural selection and artificial selection ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how modern organisms are similar to their extinct ancestors (e.g., woolly mammoth and elephant)

Science and Technology/Engineering
Pre-K–Grade 8

PHYSICAL SCIENCE

Core Idea	Access Skills	Grades Pre-K–2	Grades 3–5	Grades 6–8
Matter and Its Interactions	Pages 107–109	Pages 103–104, 106, 117–119	Pages 126–128	Pages 135, 138, 140–142
Motion and Stability: Forces and Interactions	Pages 110–111	Pages 103–104, 119–120	Pages 124, 126, 128–130	Pages 135–136, 139, 142–144
Energy	Pages 112–114	Pages 104, 106, 120–121	Pages 125–126, 130–132	Pages 136–137, 144–146
Waves and Their Applications in Technologies for Information Transfer	Pages 114–116	Pages 103, 105, 122–123	Pages 125, 132–134	Pages 135, 147–148

Grade Level: Pre-Kindergarten

Core Idea	Learning Standards as written	
Matter and Its Inter-actions	**PreK-PS1-1(MA)**	Raise questions and investigate the differences between liquids and solids and develop awareness that a liquid can become a solid and vice versa.
	PreK-PS1-2(MA)	Investigate natural and human-made objects to describe, compare, sort, and classify objects based on observable physical characteristics, uses, and whether something is manufactured or occurs in nature.
	PreK-PS1-3(MA)	Differentiate between the properties of an object and those of the material of which it is made.
	PreK-PS1-4(MA)	Recognize through investigation that physical objects and materials can change under different circumstances. Clarification Statement: ♦ Changes include building up or breaking apart, mixing, dissolving, and changing state.
Motion and Stability: Forces and Inter-actions	**PreK-PS2-1(MA)**	Using evidence, discuss ideas about what is making something move the way it does and how some movements can be controlled.
	PreK-PS2-2(MA)	Through experience, develop awareness of factors that influence whether things stand or fall. Clarification Statement: ♦ Examples of factors in children's construction play include using a broad foundation when building, considering the strength of materials, and using balanced weight distribution in a block building.
Waves and Their Applications in Tech-nologies for Information Transfer	**PreK-PS4-1(MA)**	Investigate sounds made by different objects and materials and discuss explanations about what is causing the sounds. Through play and investigations, identify ways to manipulate different objects and materials that make sound to change volume and pitch.
	PreK-PS4-2(MA)	Connect daily experiences and investigations to demonstrate the relationships between the size and shape of shadows, the objects creating the shadow, and the light source.

Grade Level: Kindergarten

Core Idea	Learning Standards as written	
Matter and Its Inter-actions	**K-PS1-1(MA)**	Investigate and communicate the idea that different kinds of materials can be solid or liquid depending on temperature. Clarification Statements: ♦ Materials chosen must exhibit solid and liquid states in a reasonable temperature range for kindergarten students (e.g., 0–80°F), such as water, crayons, or glue sticks. ♦ Only a qualitative description of temperature, such as hot, warm, and cool, is expected.
Motion and Stability: Forces and Inter-actions	**K-PS2-1**	Compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. Clarification Statements: ♦ Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other. ♦ Comparisons should be on different relative strengths or different directions, not both at the same time. ♦ Non-contact pushes or pulls such as those produced by magnets are not expected.
Energy	**K-PS3-1**	Make observations to determine that sunlight warms materials on Earth's surface. Clarification Statements: ♦ Examples of materials on Earth's surface could include sand, soil, rocks, and water. ♦ Measures of temperature should be limited to relative measures such as warmer/cooler.
	K-PS3-2	Use tools and materials to design and build a model of a structure that will reduce the warming effect of sunlight on an area. *

Grade Level: Grade 1

Core Idea	Learning Standards as written	
Waves and Their Applications in Tech-nologies for Information Transfer	**1-PS4-1**	Demonstrate that vibrating materials can make sound and that sound can make materials vibrate. Clarification Statements: ♦ Examples of vibrating materials that make sound could include tuning forks, a stretched string or rubber band, and a drum head. ♦ Examples of how sound can make materials vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.
	1-PS4-3	Conduct an investigation to determine the effect of placing materials that allow light to pass through them, allow only some light through them, block all the light, or redirect light when put in the path of a beam of light. Clarification Statements: ♦ Effects can include some or all light passing through, creation of a shadow, and redirecting light. ♦ Quantitative measures are not expected.
	1-PS4-4	Use tools and materials to design and build a device that uses light or sound to send a signal over a distance. * Clarification Statements: ♦ Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats. ♦ Technological details for how communication devices work are not expected.

Grade Level: Grade 2

Core Idea	Learning Standards as written	
Matter and Its Interactions	**2-PS1-1**	Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.
	2-PS1-2	Test different materials and analyze the data obtained to determine which materials have the properties that are best suited for an intended purpose. * Clarification Statements: ♦ Examples of properties could include, color, flexibility, hardness, texture, and absorbency. ♦ Data should focus on qualitative and relative observations.
	2-PS1-3	Analyze a variety of evidence to conclude that when a chunk of material is cut or broken into pieces, each piece is still the same material and, however small each piece is, has weight. Show that the material properties of a small set of pieces do not change when the pieces are used to build larger objects. Clarification Statements: ♦ Materials should be pure substances or microscopic mixtures that appear contiguous at observable scales. ♦ Examples of pieces could include blocks, building bricks, and other assorted small objects.
	2-PS1-4	Construct an argument with evidence that some changes to materials caused by heating or cooling can be reversed and some cannot. Clarification Statements: ♦ Examples of reversible changes could include materials such as water and butter at different temperatures. ♦ Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and burning paper.
Energy	**2-PS3-1(MA)**	Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other. Clarification Statements: ♦ Examples could include an object sliding on rough vs. smooth surfaces. ♦ Observations of temperature and speed should be qualitative.

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Inter-actions	**1. Asking questions/defining problems** ♦ Explore materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change visually or by touch (Specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change for specified time block ♦ Gain attention within a specified time block(s) to explore materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change ♦ Make a request to explore materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change within a specified amount of time ♦ Choose within a specified amount of time from an errorless array of materials related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change for a specified amount of time in a comparison activity ♦ Release or give materials related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change within a specified amount of time in a comparison activity ♦ Turn on/off technology related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change within a specified amount of time in a comparison activity ♦ Move materials related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change in a comparison activity ♦ Use two hands to manipulate materials related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change in a comparison activity	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials or models related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change ♦ Orient or manipulate materials or models related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change ♦ Functionally use materials or models related to the changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change ♦ Locate objects partially hidden or out of sight in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change activity ♦ Construct or assemble a model related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change specifying accuracy criteria

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Match object to object, object to picture, or picture to picture of materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change ♦ Activate a device within a specified amount of time to record relevant questions related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change visually or by touch (Specify accuracy criteria) **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change for a specified amount of time ♦ Release or give materials in an investigation related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change within a specified amount of time of the directive ♦ Turn on/off technology in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change investigation within a specified amount of time	**3. Analyzing and interpreting data (cont.)** ♦ Imitate action related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change or physical/chemical change in a comparison activity ♦ Initiate cause and effect response related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change within a specified time block(s) in a comparison activity ♦ Activate a device within a specified amount of time, related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change within a specified amount of time in a comparison activity ♦ Attend visually/tactually to materials related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change within a specified amount of time in a comparison activity ♦ Make a choice from an errorless array, within a specified amount of time, related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change within a specified amount of time in a comparison activity ♦ Make a choice from an errorless array, within a specified amount of time in a comparison activity about whether an object either occurs naturally or is human-made	**5. Developing and using models (cont.)** ♦ Use one object to act on another in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change (e.g., use a glue stick to attach materials with different properties) **6. Constructing explanations** ♦ Move materials related to the creation of a written product that describes the changing states of matter (solid, liquid) ♦ Choose from an array of errorless choices (within a specified amount of time) related to the creation of a written product that describes the properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical reaction/change ♦ Choose from an array of errorless choices (within a specified amount of time) related to the creation of a written product about whether an object either occurs naturally or is human-made **7. Engaging in argument from evidence** ♦ Activate a device (within a specified amount of time) to create a written product to support an argument/claim about whether an object either occurs naturally or is human-made **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Move materials in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change investigation ♦ Use two hands in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change investigation ♦ Imitate action in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change investigation ♦ Initiate cause and effect response in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change investigation within a specified time block(s) ♦ Track materials in an investigation related to changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change ♦ Choose within a specified amount of time from an errorless array of materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change during an investigation ♦ Attend visually/tactually in an investigation about whether an object either occurs naturally or is human-made	**4. Using mathematics and computational thinking** ♦ Track materials in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change activity in which a table, chart, or graph is created ♦ Functionally use materials in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of material, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change activity in the creation of a table, chart, or graph ♦ Locate objects partially hidden or out of sight in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change activity in the creation of a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph in a model representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change (e.g., glue stick to adhere materials to graph) ♦ Orient or manipulate materials in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) or physical/chemical change activity in which a table, chart, or graph is created ♦ Attend visually/tactually to materials in activity in which a table, chart, or graph is created	**8. Obtaining, evaluating, and communicating information** ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change ♦ Move or functionally use materials to communicate ideas/information representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change ♦ Match object to object, object to picture, or picture to picture of materials representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) or physical/chemical change

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions	**1. Asking questions/defining problems** ♦ Explore the effect of magnets, visually or by touch, on different materials (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) on the effect of magnets on different materials within a specified amount of time of the activity being interrupted ♦ Gain attention to explore the effect of magnets on different materials within a specified time block(s) ♦ Make a request to explore the effect of magnets on different materials within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of magnetic and non-magnetic materials to explore the effect of magnets on different materials within a specified time block(s) ♦ Match object to object, or object to picture, or picture to picture of magnets to explore the effect of magnets on different materials ♦ Activate technology (i.e. hitting a switch) within a specified amount of time, to contribute information related to magnets ♦ Match object to object, or object to picture, or picture to picture, representing the nature of the forces between two magnets ♦ Grasp (hold) materials for a specified amount of time to explore the effect of magnets on different materials **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation to explore the effect of magnets on different materials for a specified amount of time	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials for a specified amount of time in a comparison activity showing the effect of magnets on different materials ♦ Release or give materials for a specified amount of time in a comparison activity showing the effect of magnets on different materials ♦ Move materials for a specified amount of time in a comparison activity showing the effect of magnets on different materials ♦ Use two hands to manipulate materials for a specified amount of time in a comparison activity showing the effect of magnets on different materials ♦ Imitate action in a comparison activity showing the effect of magnets on different materials ♦ Initiate cause and effect response in a comparison activity related to showing the effect of magnets on different materials within a specified time block(s) ♦ Track materials in the creation of a table, chart, or graph to demonstrate the effects of sunlight or lack of sunlight on different material or the speed of moving objects	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials used in a model showing the effect of magnets on different materials ♦ Orient or manipulate materials used in a model showing the effect of magnets on different materials ♦ Functionally use materials used in a model showing the effect of magnets on different materials ♦ Locate objects partially hidden or out of sight in a magnetic model ♦ Construct or assemble a model showing the effect of magnets on different materials (specify accuracy criteria) **6. Constructing explanations** ♦ Move materials related to the creation of a written product that explains how fields (magnetic) can apply forces to objects without anything touching the object **7. Engaging in argument from evidence** ♦ Activate a device (within a specified amount of time) to create a written product to support an argument/claim about the merit of a design solution about reducing the forces on both objects in a collision

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Inter-actions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Release or give materials in an investigation to explore the effect of magnets on different materials within a specified amount of time of the directive ♦ Turn on/off technology in an investigation to explore the effect of magnets on different materials within a specified amount of time ♦ Move materials in an investigation to explore the effect of magnets on different materials ♦ Use two hands in an investigation to explore the effect of magnets on different materials ♦ Imitate action in an investigation to explore the effect of magnets on different materials ♦ Initiate cause and effect response in an investigation to explore the effect of magnets on different materials ♦ within a specified time block(s) ♦ Choose from an errorless array of materials within a specific amount of time in an investigation to explore the effect of magnets on different materials ♦ Move the materials for a specified amount of time, in an investigation to explore the nature of the forces between two magnets ♦ Initiate cause and effect in response in an investigation to explore the nature of the forces between two magnets within a specified time block(s) ♦ Visually attend to materials for a specified amount of time during an investigation about how direction/orientation affects magnets (attract/repel)	**4. Using mathematics and computational thinking** ♦ Track materials in the creation of a table, chart, or graph to demonstrate the effect of magnets on different materials within a specified time block(s) ♦ Orient or manipulate materials in the creation of a table, chart, or graph to demonstrate the effect of magnets on different materials ♦ Functionally use materials in the creation of a table, chart, or graph to demonstrate the effect of magnets on different materials ♦ Locate objects partially hidden or out of sight in the creation of a table, chart, or graph to demonstrate the effect of magnets on different materials ♦ Activate technology (within a specified amount of time) in the creation of a table, chart, or graph to demonstrate the effect of magnets on different materials ♦ Activate a device within a specified amount of time in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) activity in which a table, chart, or graph is created ♦ Attend visually/tactually to materials in a changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials (color, flexibility, texture, hardness, or absorbency) activity in which a table, chart, or graph is created	**8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing how magnets effect different materials ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing how magnets effect different materials ♦ Move or functionally use materials to communicate ideas/information representing how magnets effect different materials (e.g., voice output, switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing how magnets effect different materials ♦ Match object to object, or object to picture, or picture to picture, of materials representing how magnets effect different materials ♦ Activate technology within a specified amount of time to communicate ideas/information representing magnets or materials representing effects of different strengths or different direction on an object pushed or pulled (voice output switch, low tech) ♦ Activate device within a specified amount of time to communicate ideas/information representing changing states of matter (solid, liquid) or qualitative temperature (hot, warm, cool) or properties of materials, (color, flexibility, texture, hardness, or absorbency) ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about magnets

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy	**1. Asking questions/defining problems** ♦ Explore materials representing effects of sunlight or lack of sunlight on different material or the speed of moving objects visually or by touch (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified amount of the activity being interrupted ♦ Gain attention to explore materials representing effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified time block(s) ♦ Make a request to explore materials representing effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of materials related to effects of sunlight or lack of sunlight on different material or the speed of moving objects	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects for a specified amount of time ♦ Release or give materials in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified amount of time ♦ Turn on/off technology in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified amount of time ♦ Move materials in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Use two hands to manipulate materials in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) a model that shows the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Orient or manipulate a model that shows the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Functionally use a model that shows the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Locate objects partially hidden or out of sight in a model that shows the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Construct or assemble a model that shows the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Use one object to act on another in a model that shows the effects of sunlight or lack of sunlight on different material or the speed of moving objects (e.g., use a pointer to tap)

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Match object to object, or object to picture, or picture to picture using materials related to the effects of sunlight or lack of sunlight on different materials **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about the effects of sunlight or lack of sunlight on different material or the speed of moving objects for a specified amount of time ♦ Release or give materials in an investigation about the effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified amount of time of the directive ♦ Turn on/off technology in an investigation about the effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified amount ♦ Move materials to demonstrate effects of sunlight or lack of sunlight on different material or the speed of moving objects investigation ♦ Use two hands in an investigation about the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Imitate action in investigation about the effects of sunlight or lack of sunlight on different material or the speed of moving objects	**3. Analyzing and interpreting data (cont.)** ♦ Imitate action in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Initiate cause and effect response in a comparison activity representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified time block(s) **4. Using mathematics and computational thinking** ♦ Track materials in the creation of a table, chart, or graph to demonstrate the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Orient or manipulate materials in the creation of a table, chart, or graph to demonstrate the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Functionally use materials in the creation of a table, chart, or graph to demonstrate the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Locate objects partially hidden or out of sight in the creation of a table, chart, or graph to demonstrate the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦	**6. Constructing explanations** ♦ Move materials related to the creation of a written product that explains how the Sun impacts the relative warmth of different objects **7. Engaging in argument from evidence** ♦ Activate a device (within a specified amount of time) to create a written product to support an argument/claim about the best way to reduce the warming effects of the Sun on an object/surface **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Move or functionally use materials to communicate ideas/information representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects (e.g., Voice Output, Switch, low tech)

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)	**2. Planning and carrying out investigations** ♦ Initiate cause and effect response in an investigation about the effects of sunlight or lack of sunlight on different material or the speed of moving objects within a specified time block(s)	**4. Using mathematics and computational thinking** ♦ Use one object to act on another in the creation of a table, chart, or graph representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects	**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Choose within a specified amount of time from an errorless array of materials representing the effects of sunlight or lack of sunlight on different material or the speed of moving objects ♦ Match object to object, or object to picture, or picture to picture of materials representing the effects of sunlight or lack of sunlight on different materials, or the speed of moving objects
Waves and Their Applications in Tech-nologies for Information Transfer	**1. Asking questions/defining problems** ♦ Explore visually or by touch materials to demonstrate that sounds are produced through vibration (specify accuracy criteria) ♦ Sustain exploration of an activity to demonstrate that sounds are produced through vibration within a specified amount of time of the activity being interrupted (e.g., vocalize when activity is interrupted) ♦ Gain attention within a specified time block(s) to explore materials to demonstrate that sounds are produced through vibration ♦ Make a request to explore materials representing sounds through vibration within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array to explore materials related to sounds through vibration	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials for a specified amount of time to compare materials that make different sounds through vibration ♦ Release or give materials for a specified amount of time to compare materials that make different sounds through vibration ♦ Turn on/off technology to compare materials that make different sounds through vibration ♦ Initiate cause and effect within a specified time block(s) to compare materials that make different sounds through vibration ♦ Choose from an errorless array (specify accuracy criteria) to compare materials that make different sounds through vibration ♦ Attend visually or by touch to compare materials that make different sounds through vibration (specify accuracy criteria)	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) of a model that produces sound and/or vibration ♦ Orient or manipulate a model that produces sound and/or vibration ♦ Functionally use materials related to the model that produces sound and/or vibration ♦ Locate objects partially hidden or out of sight in a model that produces sound and/or vibration ♦ Construct or assemble model that produces sound and/or vibration (specify accuracy criteria) ♦ Use one object to act on another in a model that produces sound and/or vibration (e.g., use a pointer to tap)

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer (cont.)	**1. Asking questions/defining problems** ♦ Match object to object, or object to picture, or picture to picture of materials that demonstrate that sounds are produced through vibration ♦ Activate a device within a specified amount of time to record relevant questions related to how sounds are produced through vibration **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in an investigation about sound from vibrating objects for a specified amount of time ♦ Release or give materials in an investigation about sound from vibrating objects within a specified amount of time of the directive ♦ Turn on/off technology in an investigation about sound from vibrating objects within a specified amount of time of the directive ♦ Move materials in an investigation about sound from vibrating objects within a specified amount of time of the directive ♦ Use two hands in an investigation about sound from vibrating objects ♦ Imitate action in an investigation about sound from vibrating objects ♦ Initiate cause and effect response in an investigation about sound from vibrating objects within a specified time block(s) ♦ Attend visually or by touch in an investigation about sound from vibrating objects for a specified amount of time	**4. Using mathematics and computational thinking** ♦ Track materials to create a table, chart, or graph related to materials that make different sounds through vibration ♦ Orient or manipulate materials to create a table, chart, or graph related to materials that make different sounds through vibration ♦ Functionally use materials to create a table, chart, or graph related to materials that make different sounds through vibration ♦ Locate objects partially hidden or out of sight to create a table, chart, or graph related to materials that make different sounds through vibration ♦ Use one object to act on another to create a table, chart, or graph related to materials that make different sounds through vibration ♦ Attend visually/by touch to materials to create a table, chart, or graph related to materials that make different sounds through vibration (specify accuracy criteria) ♦ Activate a device (within a specified amount of time) during the creation of a table, chart, or graph related to materials that make different sounds through vibration	**6. Constructing explanations** ♦ Move materials related to the creation of a written product that explains how sounds are produced through vibration ♦ Activate a device within a specified amount of time to create a written product that explains how sounds are produced through vibration ♦ choose from an errorless array (specify accuracy criteria) to create a written product that explains how sounds are produced through vibration. **7. Engaging in argument from evidence** ♦ Activate a device (within a specified amount of time) to create a written product to support an argument/claim about how to change sound (e.g., pitch, volume) by manipulating a variety of objects and materials **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing materials that make different sounds through vibration ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing materials that make different sounds through vibration

ACCESS SKILLS to Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Tech-nologies for Information Transfer (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Move or functionally use materials to communicate ideas/information representing materials that make different sounds through vibration (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials that make different sounds through vibration ♦ Match object to object, or object to picture, or picture to picture of materials that generate sounds through vibration ♦ Match object to object, or object to picture, or picture to picture of materials that generate sounds through vibration ♦ Activate a device (within a specified amount of time) to communicate ideas/information representing materials that make different sounds through vibration

ENTRY POINTS to
Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Inter-actions	**1. Asking questions/defining problems** ♦ Record relevant questions about the characteristics of solids and liquids based on observations ♦ Record relevant questions about the physical characteristics of natural and man-made materials based on observations ♦ Record relevant questions about how heating/cooling causes changes to solids and liquids that may or may not be able to be reversed based on observations ♦ Record relevant questions about how a liquid can change to a solid and vice-versa based on observations ♦ Identify questions that can be answered by an investigation about how the properties of a material remain the same when broken into smaller pieces (e.g., building bricks, clay) ♦ Define a simple problem related to the type of materials needed for an intended purpose (e.g., determining types of materials needed for a boat) ♦ Identify questions that can be answered by an investigation, about the characteristics of solids and liquids **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the type of materials best suited for an intended purpose ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the characteristics (hardness, color, flexibility, texture) of solids and liquids	**3. Analyzing and interpreting data** ♦ Group information/data about the physical characteristics of natural and man-made materials to identify patterns. ♦ Group information/data about the characteristics (hardness, color, flexibility, texture) of solids and liquids to identify patterns. ♦ Compare predictions to the data and/or observations from an investigation about the type of materials needed for an intended purpose ♦ Compare predictions to the data and/or observations from an investigation about how heating/cooling causes changes to solids and liquids ♦ Display data using pictures to show how the properties of a material remain the same when broken into smaller pieces **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about how heating/cooling causes changes to solids and liquids ♦ Use counting and numbers to show data about the weight of a whole object and the weight of the object when broken into pieces ♦ Identify the qualitative and quantitative information about how heating/cooling causes changes to solids and liquids that may or may not be able to be reversed	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain that heating/cooling causes changes to solids and liquids that may or may not be able to be reversed ♦ Illustrate, construct, and/or label a model to show/explain the type of materials best suited for an intended purpose ♦ Illustrate, construct, and/or label a model to show/explain that the properties of a material remain the same when broken into smaller pieces ♦ Illustrate, construct, and/or label a model to show/explain the differences between a liquid and a solid ♦ Illustrate, construct, and/or label a model to show/explain the differences between natural and man-made materials **6. Constructing explanations** ♦ Describe how observable properties are used to categorize solids or liquids ♦ Describe how observable properties are used to categorize natural and man-made materials ♦ Describe how heating/cooling causes changes to solids and liquids that may or may not be able to be reversed ♦ Identify observations that match descriptions about the differences between a liquid and a solid

ENTRY POINTS to
Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the physical characteristics of natural and man-made materials ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how a liquid can change to a solid and vice-versa ♦ Use pictures and/or drawings to collect observations related to how heating/cooling causes changes to solids and liquids		**6. Constructing explanations (cont.)** ♦ Identify observations that match descriptions about how the properties of a material remain the same when broken into smaller pieces ♦ Generate a solution to a problem related to selecting the type of materials best suited for an intended purpose using pictures or drawings **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about the type of materials best suited for an intended purpose ♦ Use scientific evidence in support of an argument about whether an object either occurs naturally or is human-made ♦ Use scientific evidence in support of an argument about how heating/cooling causes changes to solids and liquids that may or may not be able to be reversed ♦ Use scientific evidence in support of an argument about how the properties of a material remain the same when broken into smaller pieces **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about the observable properties are used to categorize solids or liquids

ENTRY POINTS to Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Recall and present information from observations, text, or media source about the observable properties are used to categorize natural and man-made materials ♦ Communicate scientific information or ideas about how heating/cooling causes changes to solids and liquids that may or may not be able to be reversed
Motion and Stability: Forces and Interactions	**1. Asking questions/defining problems** ♦ Record relevant questions about forces (pushes and pulls) that act upon an object based on observations ♦ Identify questions that can be answered by an investigation about forces (pushes and pulls) that act upon an object ♦ Identify questions that can be answered by an investigation about how an object will move as a result of applying a force ♦ Define a simple problem related to factors that influence whether an object stands or falls (e.g., constructed tower, house of cards) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how the motion of an object changes when forces of different strengths and/or direction are applied	**3. Analyzing and interpreting data** ♦ Group information/data about forces (pushes and pulls) that act upon an object by how the motion of the object changes, to identify patterns. ♦ Compare predictions to the data and/or observations from an investigation about whether an object will move as a result of applying a force ♦ Compare predictions to the data and/or observations from an investigation about whether an object stands or falls (e.g., constructed tower, house of cards) ♦ Display data using a simple graph or pictures to show the results of forces (pushes and pulls) that act upon an object (e.g., distance or direction an object moves)	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain how the motion of an object changes when forces of different strengths and/or direction are applied ♦ Illustrate, construct, and/or label a model to show/explain forces (pushes and pulls) that act upon an object ♦ Illustrate, construct, and/or label a model to show/explain what makes objects move ♦ Illustrate, construct, and/or label a model to show/explain why an object stands or falls **6. Constructing explanations** ♦ Describe how the strength of a push or pull affects the movement of an object ♦ Identify observations the match descriptions about what makes objects move ♦ Generate a solution to a problem related to whether an object stands or falls using pictures or drawings

ENTRY POINTS to
Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Inter-actions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about forces (pushes and pulls) that act upon an object ♦ Record observations (e.g., firsthand experiences, media) to collect data related to forces (pushes and pulls) that act upon an object ♦ Use pictures and/or drawings to collect observations related to factors that influence whether an object stands or falls (e.g., constructed tower, house of cards)	**4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the time it takes an object to travel a certain distance after different strength forces are applied ♦ Identify the qualitative and quantitative information about how the motion of an object changes when forces of different strengths and/or direction are applied (e.g., faster/slower, seconds)	**7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how the motion of an object changes when different forces are applied to the object ♦ Use scientific evidence in support of an argument about the best way to prevent a structure from falling (e.g., constructed tower, house of cards) **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about how pushes or pulls affect the movement of an object ♦ Communicate scientific information or ideas about what makes objects move ♦ Communicate scientific information or ideas about how the motion of an object changes when forces of different strengths and/or direction are applied
Energy	**1. Asking questions/defining problems** ♦ Record relevant questions about friction based on observations ♦ Identify questions that can be answered by an investigation about why different objects feel warmer than other objects when exposed to the Sun ♦ Define a simple problem related to how different materials are heated by the Sun (e.g., water, metal, colors of fabric)	**3. Analyzing and interpreting data** ♦ Group information/data about the relative warmth of objects made of different materials when they are exposed to the Sun by their characteristics (e.g., color, metallic/non-metallic) to identify patterns. ♦ Compare predictions to the data and/or observations from an investigation about the effects of friction (i.e., rubbing two objects together or sliding an object on different surfaces)	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain which surfaces cause objects to slide faster or slower ♦ Illustrate, construct, and/or label a model to show/explain the relative warmth of objects made of different materials when they are exposed to the Sun ♦ Distinguish between a model and the actual process of warming objects in the Sun (e.g., Sun vs. heat lamp)

ENTRY POINTS to
Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the relative warmth of objects made of different materials when they are exposed to the Sun ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how friction affects the temperature and/or speed of objects rubbing together ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how the texture of materials affects the friction of the material (e.g., rough, smooth)	**3. Analyzing and interpreting data (cont.)** ♦ Display data using a simple graph or pictures to show the relative warmth of objects made of different materials when they are exposed to the Sun **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about which surfaces cause objects to slide faster or slower ♦ Identify the qualitative and quantitative information about the relative warmth of objects made of different materials when they are exposed to the Sun	**6. Constructing explanations** ♦ Describe how the Sun impacts the relative warmth of different objects ♦ Identify observations that match descriptions about which surfaces cause objects to slide faster or slower ♦ Generate a solution to a problem related to reducing the warming effects of sunlight on an object/surface using pictures or drawings **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how friction affects the motion of objects based on variations in the surfaces (e.g., smooth vs. lightly textured surface vs. carpet) ♦ Use scientific evidence in support of an argument about the best way to reduce the warming effects of the Sun on an object/surface **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about how friction affects the temperature and/or speed of objects rubbing together ♦ Communicate scientific information or ideas about friction ♦ Communicate scientific information or ideas about the warming effects of the Sun

ENTRY POINTS to
Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer	**1. Asking questions/defining problems** ♦ Record relevant questions about shadows based on observations ♦ Record relevant questions about sound from vibrating objects based on observations ♦ Identify questions that can be answered by an investigation about making sound using various materials (e.g., different volume and pitch) ♦ Identify questions that can be answered by an investigation about using light or sound to send a signal over a distance **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how sounds are produced by vibrating objects and/or materials ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how to create changes in the pitch or volume of a given sound (e.g., stretching a rubber band, striking an object differently) ♦ Plan and/or follow the steps of an investigation to collect data and/or observations to test a device that transmits a message across the room using light or sound (e.g., string telephone)	**3. Analyzing and interpreting data** ♦ Group information/data about the loudness of sounds produced by striking objects differently (e.g., varying degrees of strength) to identify patterns ♦ Group information/data about how the path of light will change according to the characteristics of the object it strikes to identify patterns ♦ Compare predictions to the data and/or observations from an investigation about how to create changes in the pitch or volume of a given sound ♦ Compare predictions to the data and/or observations from an investigation about a device that transmits a message across the room using light or sound ♦ Display data using a simple graph or pictures to show how the position of a light source affects the size/shape of a shadow created by an object **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about how the position of a light source affects the size of a shadow created by an object ♦ Identify the qualitative and quantitative information about how the position of a light source affects the size/shape of a shadow created by an object	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain how the position of a light source affects the size/shape of a shadow created by an object ♦ Illustrate, construct, and/or label a model to show/explain how to create changes in the pitch or volume of a given sound ♦ Illustrate, construct, and/or label a model to show/explain a device that transmits a message across the room using light or sound **6. Constructing explanations** ♦ Describe how light will/will not pass through various materials ♦ Describe how sounds are changed by manipulating a variety of objects and materials ♦ Identify observations that match descriptions about how the position of a light source affects the size/shape of a shadow created by an object ♦ Generate a solution to a problem related to using light or sound to send a signal over a distance using pictures or drawings

ENTRY POINTS to
Physical Science Standards in Grades Pre-K–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Tech-nologies for Information Transfer (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how the path of light will change according to the characteristics of the object it strikes ♦ Use pictures and/or drawings to collect observations related to how the position of a light source affects the size/shape of a shadow created by an object		**7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about how to change the size/shape of a shadow created by an object ♦ Use scientific evidence in support of an argument about the best method to transmit a message across the room using light or sound ♦ Use scientific evidence in support of an argument about how to change sound (e.g., pitch, volume) by manipulating a variety of objects and materials **8. Obtaining, evaluating, and communicating information** ♦ Recall and present information from observations, text, or media source about how the position of a light source affects the size/shape of a shadow created by an object ♦ Recall and present information from observations, text, or media source about how to create changes in the pitch or volume of a given sound ♦ Communicate scientific information or ideas about a device that transmits a message across the room using light or sound

Grade Level: Grade 3

Core Idea	Learning Standards as written	
Motion and Stability: Forces and Interactions	**3-PS2-1**	Provide evidence to explain the effect of multiple forces, including friction, on an object. Include balanced forces that do not change the motion of the object and unbalanced forces that do change the motion of the object. Clarification Statements: ♦ Descriptions of force magnitude should be qualitative and relative. ♦ Force due to gravity is appropriate but only as a force that pulls objects down.
	3-PS2-3	Conduct an investigation to determine the nature of the forces between two magnets based on their orientations and distance relative to each other. Clarification Statement: ♦ Focus should be on forces produced by magnetic objects that are easily manipulated.
	3-PS2-4	Define a simple design problem that can be solved by using interactions between magnets. * Clarification Statement: ♦ Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.

Grade Level: Grade 4

Core Idea	Learning Standards as written	
Energy	**4-PS3-1**	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
	4-PS3-2	Make observations to show that energy can be transferred from place to place by sound, light, heat, and electric currents. Clarification Statement: ♦ Evidence of energy being transferred can include vibrations felt a small distance from a source, a solar-powered toy that moves when placed in direct light, warming a metal object on one end and observing the other end getting warm, and a wire carrying electric energy from a battery to light a bulb.
	4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide. Clarification Statement: ♦ Changes in energy can include a change in the object's motion, position, and the generation of heat and/or sound.
	4-PS3-4	Apply scientific principles of energy and motion to test and refine a device that converts kinetic energy to electrical energy or uses stored energy to cause motion or produce light or sound. * Clarification Statement: ♦ Sources of stored energy can include water in a bucket, or a weight suspended at a height, and a battery.
Waves and Their Applications in Tech-nologies for Information Transfer	**4-PS4-1**	Develop a model of a simple mechanical wave (including sound) to communicate that waves (a) are regular patterns of motion along which energy travels and (b) can cause objects to move. Clarification Statement: ♦ Examples of models could include diagrams, analogies, and physical models.
	4-PS4-2	Develop a model to describe that light must reflect off an object and enter the eye for the object to be seen.
	4-PS4-3	Develop and compare multiple ways to transfer information through encoding, sending, receiving, and decoding a pattern. * Clarification Statement: ♦ Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture, and using Morse code to send text.

Grade Level: Grade 5

Core Idea	Learning Standards as written	
Matter and Its Interactions	**5-PS1-1**	Use a particle model of matter to explain common phenomena involving gases, and phase changes between gas and liquid and between liquid and solid. Clarification Statement: ♦ Examples of common phenomena the model should be able to describe include adding air to expand a balloon, compressing air in a syringe, and evaporating water from a salt water solution.
	5-PS1-2	Measure and graph the weights (masses) of substances before and after a reaction or phase change to provide evidence that regardless of the type of change that occurs when heating, cooling, or combining substances, the total weight (mass) of matter is conserved. Clarification Statement: ♦ Assume that reactions with any gas production are conducted in a closed system.
	5-PS1-3	Make observations and measurements of substances to describe characteristic properties of each, including color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility. Clarification Statements: ♦ Emphasis is on describing how each substance has a unique set of properties. ♦ Examples of substances could include baking soda and other powders, metals, minerals, and liquids.
	5-PS1-4	Conduct an experiment to determine whether the mixing of two or more substances results in new substances with new properties (a chemical reaction) or not (a mixture).
Motion and Stability: Forces and Interactions	**5-PS2-1**	Support an argument with evidence that the gravitational force exerted by Earth on objects is directed toward Earth's center.
Energy	**5-PS3-1**	Use a model to describe that the food animals digest (a) contains energy that was once energy from the Sun, and (b) provides energy and nutrients for life processes, including body repair, growth, motion, body warmth, and reproduction. Clarification Statement: ♦ Examples of models could include diagrams and flow charts.

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about phase changes (i.e., changes between solids, liquids, or gases) ♦ Use observations and/or data to ask relevant questions about the weights (masses) of substances before and after a chemical reaction and/or phase change ♦ Use observations and/or data to ask relevant questions about whether combining two substances results in a new substance or a mixture ♦ Identify questions that can be answered by an investigation about physical and chemical changes ♦ Generate scientific questions about the characteristics of specific materials (e.g., are they absorbent, reflective, transparent; do they retain heat?) ♦ Identify questions that can be answered by an investigation about phase changes **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about solids, liquids, and gases ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about changes in weight (mass) of a substance in a closed container or system as a result of heating, cooling, or combining with another substance	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about phase changes ♦ Use data and/or observations to identify patterns about the characteristic properties of different materials (e.g., metals have similar properties) ♦ Use data and/or observations to identify relationships between changes in properties and chemical reactions ♦ Use data and/or observations to identify relationships between the weights (masses) of substances before and after a chemical reaction and/or physical change (e.g., phase change or mixture) ♦ Draw conclusions based on evidence (e.g., from an investigation) about whether combining two substances results in a new substance or a mixture ♦ Compare predictions to the data and/or observations from an investigation regarding characteristics of materials before and after a chemical or physical change **4. Using mathematics and computational thinking** ♦ Describe, measure, and/or compare the weight (mass) of a substance before and after a chemical reaction and/or physical change (e.g., phase change or mixture)	**5. Developing and using models** ♦ Compare models of different substances in a specific phase to identify common features and differences. ♦ Illustrate or develop a model to show/explain phase changes between gases, liquids, and solids ♦ Illustrate or develop a model to show/explain common phenomena involving gases (e.g., adding air to expand a balloon, compressing air in a syringe) **6. Constructing explanations** ♦ Describe how substances change from liquid to gas and vice versa and/or liquids to solids and vice versa ♦ Describe the relationship between gases, liquids, and solids ♦ Describe the relationship between the weights (masses) of substances before and after a chemical reaction and/or physical change (e.g., phase change or mixture) ♦ Explain how to determine that the characteristic properties of a substance have changed ♦ Explain how to determine whether combining two substances results in a new substance or a mixture ♦ Explain common phenomena involving gases (e.g., adding air to expand a balloon, compressing air in a syringe)

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Select the best method to collect data and/or observations about how objects change state, either from solid to liquid, liquid to gas, liquid to solid, and/or gas to liquid ♦ Record observations (e.g., firsthand experiences, media) to collect data related to whether a substance is the result of a physical or chemical change ♦ Record observations (e.g., firsthand experiences, media) to collect data related to characteristics of materials (e.g., reflective (light), conductive (thermal or electrical), soluble, and/or attracted to a magnet) ♦ Record observations (e.g., firsthand experiences, media) to collect data related to characteristics of two substances before and after they are combined	**4. Using mathematics and computational thinking (cont.)** ♦ Organize the qualitative and quantitative information about characteristic properties of different materials (e.g., hardness, density)	**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that substance(s) used to create a particular object is well-suited to the object's purpose (e.g., describing materials used to insulate against heat or cold; why non-absorbing materials are used to make containers to hold liquids) ♦ Use scientific evidence to support a claim about whether or not a chemical reaction occurred ♦ Use scientific evidence to support a claim about whether or not mass is conserved in a chemical reaction and/or physical change (e.g., phase change or mixture) **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about how objects change state ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how objects change state ♦ Research and present information about how combining two or more substances produces either a chemical reaction or a mixture

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions	**1. Asking questions/defining problems** ♦ Identify questions that can be answered by an investigation about balanced and unbalanced forces ♦ Generate scientific questions about the forces that can act on an object ♦ Use observations and/or data to ask relevant questions about magnets ♦ Define a simple problem that can be solved using magnets (e.g., replacing buttons/snaps on clothes, holding a door closed, moving an object that you should not touch with your hands) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the forces between two magnets (e.g., changing distance between magnets, changing orientation of magnets) ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the types of materials that interact with magnets (e.g., objects that can be attracted to magnets) ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how changing the size of a force that acts on an object will change its motion, provided the other forces (e.g., weight, gravity, environmental conditions) remain the same	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about whether objects will respond to a magnet (e.g., magnetic/non-magnetic objects, distance from the magnet) ♦ Use data and/or observations to identify patterns about balanced and unbalanced forces acting on an object ♦ Use data and/or observations to identify relationships between the forces acting on an object and changes in the motion of the object ♦ Evaluate data and/or observations from tests of an object or tool related to magnets to determine if it works as intended. ♦ Use data and/or observations to identify patterns about gravitational force ♦ Draw conclusions based on evidence (e.g., from an investigation) about how orientation and/or distance effects how two magnets interact ♦ Compare predictions to the data and/or observations to identify relationship between the forces acting on an object and changes in the motion of the object	**5. Developing and using models** ♦ Compare models that show/explain gravitational forces to identify common features and differences. ♦ Illustrate or develop a model to show/explain the direction and magnitude of the forces acting on an object, including gravity ♦ Illustrate or develop a model to show/explain the direction and magnitude of the forces between two magnets **6. Constructing explanations** ♦ Explain how the distance between two magnets affects the strength of the magnetic force between them ♦ Explain how the orientation of two magnets affects whether the magnets attract or repel ♦ Use tools and/or materials to build a device that solves a specific problem using magnets ♦ Generate and/or compare multiple solutions to a problem that can be solved using magnets ♦ Describe how gravity's direction is related to the Earth ♦ Describe the relationship between balanced/unbalanced forces and changes in motion of an object

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Select the best method to collect data and/or observations about balanced and unbalanced forces on an object ♦ Record observations (e.g., firsthand experiences, media) to collect data related to balanced and unbalanced forces on an object ♦ Record observations (e.g., firsthand experiences, media) to collect data related to magnetic/nonmagnetic materials.	**4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the how balanced and unbalanced forces may change the motion of an object ♦ Describe, measure, and/or compare quantitative attributes of the forces acting on an object ♦ Organize the qualitative and quantitative information about interactions between two magnets with the orientation and/or distance between the magnets had changed	**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim as to why certain objects are magnetic while others are non-magnetic ♦ Use scientific evidence to support a claim that gravity is directed towards Earth's center **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about Earth's gravity ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how multiple forces can be acting on an object at the same time ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how balanced or unbalanced forces affect the change in motion of an object ♦ Research and present information about the nature of forces between two magnets based on orientation and/or distance relative to each other

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy	**1. Asking questions/defining problems** ♦ Generate scientific questions about how energy transfers when two objects collide ♦ Use observations and/or data to ask relevant questions about the energy of a moving object ♦ Identify questions that can be answered by an investigation about how energy is transferred when two objects collide ♦ Define a simple problem that can be solved related to transferring energy from one form to another (e.g., from electrical to kinetic) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how the sun's energy (radiation) affects the growth of plants ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about the transfer of energy from one object to another (e.g., changes in motion, position, and/or the generation of heat/sound when objects collide) ♦ Select the best method to collect data and/or observations about how the speed of an object relates to its energy ♦ Record observations (e.g., firsthand experiences, media) to collect data related to the changes that occur when objects collide, including changes in the object's motion, position, and the generation of heat and/or sound	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about the changes in energy that will occur when objects collide, including changes in the object's motion, position, and the generation of heat and/or sound. ♦ Use data and/or observations to identify patterns about the transfer of energy that happens when objects collide ♦ Use data and/or observations to identify relationships between energy transfers and sound/light/heat ♦ Evaluate data and/or observations from tests of an object or tool related to energy transfers to determine if it works as intended ♦ Draw conclusions based on evidence (e.g., from an investigation) about the relationship between the speed of an object and its energy (kinetic) **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about the growth of plants when exposed to different amounts of the sun's energy ♦ Describe, measure, and/or compare quantitative attributes of an energy transfer device ♦ Organize the qualitative and quantitative information about the changes that occur when two objects collide	**5. Developing and using models** ♦ Compare models of energy transfers between the sun, plants, and animals that eat plants to identify common features and differences. ♦ Illustrate or develop a model to show/explain how different forms of energy are transferred from place to place by sound, light, heat, and/or electrical currents ♦ Illustrate or develop a model to show/explain how energy is transferred from one object to another when they collide **6. Constructing explanations** ♦ Draw and/or explain a design solution that uses energy transfers to solve a problem ♦ Generate and/or compare multiple solutions to a problem related to energy transfers ♦ Describe how energy is transferred when objects collide (e.g., motion, heat, light, sound) ♦ Describe the relationship between the forms of energy that are transferred from place to place by sound, light, heat, and/or electrical currents ♦ Explain how the energy animals get from digested food originates from the sun's energy

ENTRY POINTS to Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)			**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that the sun's light energy is transferred to different forms of energy (e.g., heat energy, food energy) ♦ Use scientific evidence to support a claim that sound is energy transferred from one point to another ♦ Use scientific evidence to support a claim that objects with more speed have more energy **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about how the sun's energy is transferred to plant-eating animals ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how energy can be transferred from one object to another when they collide ♦ Research and present information about how energy can be transferred from place to place (e.g., heat, sound, light, electricity)

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask relevant questions about the patterns of waves ♦ Identify questions that can be answered by an investigation about the movement of objects and energy when a wave is transmitted through a material ♦ Define a simple problem that can be solved related to encoding, sending, receiving, and decoding patterns of information ♦ Use observations and/or data to ask relevant questions about how light allows eyes to see **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about how some materials reflect or transmit waves better than others (e.g., mirror, glass) ♦ Select the best method to collect data and/or observations about the patterns related to mechanical waves ♦ Record observations (e.g., firsthand experiences, media) to collect data related to how light reflects off of objects	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an investigation about patterns related to mechanical waves ♦ Use data and/or observations to identify patterns about how light reflects off objects ♦ Use data and/or observations to identify patterns that reveal a code for encoding and decoding information ♦ Use data and/or observations to identify patterns about how light must reflect off an object and hit the eye for the object to be seen ♦ Compare predictions to the data and/or observations from an investigation about patterns related to how light must reflect off an object and hit the eye for the object to be seen **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about which materials cause light waves to either be reflected, absorbed, or passed through ♦ Describe, measure, and/or compare quantitative attributes of mechanical wave patterns ♦ Organize the qualitative and quantitative information about the movement of objects and energy transferred by waves ♦ Use counting and numbers to show data about how light must reflect off an object and hit the eye for the object to be seen	**5. Developing and using models** ♦ Distinguish between a model and the actual process of energy transmission using a wave ♦ Compare models of mechanical waves to identify common features and differences. ♦ Illustrate or develop a model to show/explain how the patterns of sound and/or light can be used to communicate information (e.g., Morse code, drumbeats, or student generated code) ♦ Illustrate or develop a model to show/explain how waves can be reflected, absorbed, or passed through various materials ♦ Illustrate or develop a model to show/explain how light must reflect off an object and hit the eye for the object to be seen **6. Constructing explanations** ♦ Describe how the characteristics of a wave show that it is a repeating pattern ♦ Describe how waves cause objects to move ♦ Draw and/or explain a design solution for encoding, sending, receiving, and decoding information using a pattern ♦ Describe how some materials allow waves to pass through while others cause waves to be absorbed or reflected ♦ Describe the relationship between light waves and the eye's ability to see

ENTRY POINTS to
Physical Science Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer (cont.)		**4. Using mathematics and computational thinking (cont.)** ♦ Organize the qualitative and quantitative information about how light must reflect off an object and hit the eye for the object to be seen	**7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim that light must reflect off an object and enter the eye for the object to be seen ♦ Use scientific evidence to support a claim that waves transmit energy ♦ Use scientific evidence to support a claim that information can be transferred by encoding and decoding using a pattern (e.g., a pattern the student designed) **8. Obtaining, evaluating, and communicating information** ♦ Compare two informational sources to determine similarities and differences in how they present information about the encoding, sending, receiving, and decoding of information using patterns ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how waves transfer energy and move objects ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how light allows the eye to see ♦ Research and present information about the repeating pattern of mechanical waves

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 6

Core Idea	Learning Standards as written	
Matter and Its Interactions	**6.MS-PS1-6**	Plan and conduct an experiment involving exothermic and endothermic chemical reactions to measure and describe the release or absorption of thermal energy. Clarification Statements: ♦ Emphasis is on describing transfer of energy to and from the environment. ♦ Examples of chemical reactions could include dissolving ammonium chloride or calcium chloride.
	6.MS-PS1-7(MA)	Use a particulate model of matter to explain that density is the amount of matter (mass) in a given volume. Apply proportional reasoning to describe, calculate, and compare relative densities of different materials.
	6.MS-PS1-8(MA)	Conduct an experiment to show that many materials are mixtures of pure substances that can be separated by physical means into their component pure substances. Clarification Statement: ♦ Examples of common mixtures include salt water, oil and vinegar, milk, and air.
Motion and Stability: Forces and Interactions	**6.MS-PS2-4**	Use evidence to support the claim that gravitational forces between objects are attractive and are only noticeable when one or both of the objects have a very large mass. Clarification Statement: ♦ Examples of objects with very large masses include the Sun, Earth, and other planets.
Waves and Their Applications in Tech-nologies for Information Transfer	**6.MS-PS4-1**	Use diagrams of a simple wave to explain that (a) a wave has a repeating pattern with a specific amplitude, frequency, and wavelength, and (b) the amplitude of a wave is related to the energy of the wave.
	6.MS-PS4-2	Use diagrams and other models to show that both light rays and mechanical waves are reflected, absorbed, or transmitted through various materials. Clarification Statements: ♦ Materials may include solids, liquids, and gases. ♦ Mechanical waves (including sound) need a material (medium) through which they are transmitted. ♦ Examples of models could include drawings, simulations, and written descriptions.
	6.MS-PS4-3	Present qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses representing 0s and 1s) can be used to encode and transmit information.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
Motion and Stability: Forces and Interactions	**7.MS-PS2-3**	Analyze data to describe the effect of distance and magnitude of electric charge on the strength of electric forces. Clarification Statement: ♦ Includes both attractive and repulsive forces.
	7.MS-PS2-5	Use scientific evidence to argue that fields exist between objects with mass, between magnetic objects, and between electrically charged objects that exert force on each other even though the objects are not in contact. Clarification Statement: ♦ Emphasis is on evidence that demonstrates the existence of fields, limited to gravitational, electric, and magnetic fields.
Energy	**7.MS-PS3-1**	Construct and interpret data and graphs to describe the relationships among kinetic energy, mass, and speed of an object. Clarification Statements: ♦ Examples could include riding a bicycle at different speeds and rolling different-sized rocks downhill. ♦ Consider relationships between kinetic energy vs. mass and kinetic energy vs. speed separate from each other; emphasis is on the difference between the linear and exponential relationships.
	7.MS-PS3-2	Develop a model to describe the relationship between the relative positions of objects interacting at a distance and their relative potential energy in the system. Clarification Statements: ♦ Examples of objects within systems interacting at varying distances could include Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a stream of water. ♦ Examples of models could include representations, diagrams, pictures, and written descriptions of systems.
	7.MS-PS3-3	Apply scientific principles of energy and heat transfer to design, construct, and test a device to minimize or maximize thermal energy transfer.* Clarification Statement: ♦ Examples of devices could include an insulated box, a solar cooker, and a vacuum flask.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
Energy (cont.)	**7.MS-PS3-4**	Conduct an investigation to determine the relationships among the energy transferred, how well the type of matter retains or radiates heat, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
	7.MS-PS3-5	Present evidence to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. Clarification Statement: ♦ Examples of empirical evidence could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of an object.
	7.MS-PS3-6(MA)	Use a model to explain how thermal energy is transferred out of hotter regions or objects and into colder ones by convection, conduction, and radiation.
	7.MS-PS3-7(MA)	Use informational text to describe the relationship between kinetic and potential energy and illustrate conversions from one form to another. Clarification Statement: ♦ Types of kinetic energy include motion, sound, thermal, and light; types of potential energy include gravitational, elastic, and chemical.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
Matter and Its Interactions	**8.MS-PS1-1**	Develop a model to describe that (a) atoms combine in a multitude of ways to produce pure substances which make up all of the living and nonliving things that we encounter, (b) atoms form molecules and compounds that range in size from two to thousands of atoms, and (c) mixtures are composed of different proportions of pure substances. Clarification Statement: ♦ Examples of molecular-level models could include drawings, three-dimensional ball and stick structures, and computer representations showing different molecules with different types of atoms.
	8.MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. Clarification Statements: ♦ Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with HCl. ♦ Properties of substances include density, melting point, boiling point, solubility, flammability, and odor.
	8.MS-PS1-4	Develop a model that describes and predicts changes in particle motion, relative spatial arrangement, temperature, and state of a pure substance when thermal energy is added or removed. Clarification Statements: ♦ Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. ♦ Examples of models could include drawings and diagrams. ♦ Examples of pure substances could include water, carbon dioxide, and helium.
	8.MS-PS1-5	Use a model to explain that atoms are rearranged during a chemical reaction to form new substances with new properties. Explain that the atoms present in the reactants are all present in the products and thus the total number of atoms is conserved. Clarification Statement: ♦ Examples of models can include physical models or drawings, including digital forms, that represent atoms.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
Motion and Stability: Forces and Interactions	**8.MS-PS2-1**	Develop a model that demonstrates Newton's third law involving the motion of two colliding objects.
	8.MS-PS2-2	Provide evidence that the change in an object's speed depends on the sum of the forces on the object (the net force) and the mass of the object. Clarification Statement: ♦ Emphasis is on balanced (Newton's first law) and unbalanced forces in a system, qualitative comparisons of forces, mass, and changes in speed (Newton's second law) in one dimension.

ENTRY POINTS to
Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in an investigation about chemical reactions (e.g., whether or not a chemical reaction occurred, energy absorption/release in a chemical reaction) ♦ Identify scientific (testable) and non-scientific (non-testable) questions about exothermic and endothermic reactions ♦ Identify scientific (testable) and non-scientific (non-testable) questions about the density of different materials ♦ Generate scientific questions about the atoms, molecules, and/or compounds based on research and/or observations ♦ Generate scientific questions about the physical changes of substances based on research and/or observations **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about exothermic and endothermic reactions to produce data/observations to serve as evidence ♦ Plan and/or conduct an investigation about physical changes of substances to produce data/observations to serve as evidence ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about density	**3. Analyzing and interpreting data** ♦ Use observations and/or data from an investigation to determine whether a chemical or physical change has occurred ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the densities of different materials ♦ Analyze and interpret data to make sense of exothermic and endothermic reactions ♦ Use observations and/or data to evaluate the process of separating a mixture into pure substances **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the rearrangement of atoms in chemical reactions ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) about exothermic and endothermic reactions ♦ Calculate the density of objects using the ratio of the mass to the volume	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain how atoms are rearranged to form a new substance during a chemical reaction ♦ Develop, revise, and/or use a model to show/explain the effects of adding or removing thermal energy to a pure substance ♦ Develop, revise, and/or use a model to show/explain how the spatial arrangement and particle motion of a substance changes when it changes states (changes between solid, liquid, and gas) ♦ Develop, revise, and/or use a model to show/explain how materials have different densities ♦ Develop, revise, and/or use a model to show/explain how the energy absorption/release in exothermic/endothermic reactions **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how the spatial arrangement of molecules changes when thermal energy is added or removed ♦ Generate and compare multiple solutions to a problem related to density ♦ Use observations and data from investigations to design a solution to a problem related to density ♦ Explain the relationship between the substances before (reactants) and after (products) a chemical reaction

ENTRY POINTS to
Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about whether a chemical or physical change has occurred ♦ Test two different models of the same proposed design solution related to density to determine which better meets criteria for success ♦ Test two different methods for separating mixtures into pure substances to determine which better meets criteria for success		**6. Constructing explanations (cont.)** ♦ Explain the relationship between atoms, molecules, and compounds **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about whether or not a material will float in water ♦ Use scientific evidence and observations to construct an argument about whether a chemical or physical change occurred ♦ Compare and critique two arguments about the best method to separate a mixture into pure substances **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain the effects of adding or removing thermal energy on a solid, liquid, and/or gas ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the rearrangement of atoms in a chemical reaction ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about exothermic and endothermic reactions ♦ Research and present information (e.g., from an investigation) on the relative densities of substances and/or objects

ENTRY POINTS to Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research and present information (e.g., from an investigation) to demonstrate the differences between physical and chemical changes
Motion and Stability: Forces and Interactions	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in an investigation about the change in speed of an object when unbalanced forces are applied (e.g., different applied forces, different masses) ♦ Ask questions about what would happen if a variable was changed in an investigation about collisions (e.g., changing the masses of colliding objects) ♦ Identify scientific (testable) and non-scientific (non-testable) questions about the presence of a field (i.e., magnetic, electric, or gravitational fields) ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a problem related to the forces in collisions. ♦ Generate scientific questions about gravitational, electric, and/or magnetic fields based on research and/or observations	**3. Analyzing and interpreting data** ♦ Analyze and interpret data to make sense of how the forces on both objects in a collision are equal and opposite. ♦ Represent data visually (e.g., bar graphs, pictographs, and/or simple line graphs) to reveal patterns about how changes in mass and/or changes in applied force effect the change in speed of an object. ♦ Compare and contrast data showing the change in speed of objects with different masses when the same force is applied ♦ Use observations and/or data to evaluate and/or refine design solutions related to reducing the force on both objects in a collision. ♦ Use observations and/or data from an investigation to determine how distance affects the strength of an electric and/or magnetic field ♦ Analyze and interpret data to make sense of how to determine the presence/absence of electric and/or magnetic fields ♦ Compare and contrast data showing the masses of objects and the gravitational force between the two objects	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain the field (i.e., electric, magnetic, gravitational) that is present around a charge, magnet, and/or very large mass. ♦ Develop, revise, and/or use a model to show/explain the forces applied to both objects in a collision ♦ Develop, revise, and/or use a model to show/explain how different masses affect the change in speed when the same force is applied ♦ Develop, revise, and/or use a model to show/explain how different applied forces affect the change in speed when the mass of the objects is the same **6. Constructing explanations** ♦ Explain how fields can apply forces to objects without anything touching the object. ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how different masses affect the change in speed when the same force is applied ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about how different applied forces affect the change in speed when the mass of the objects is the same

ENTRY POINTS to
Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about balanced and unbalanced forces to produce data/observations to serve as evidence ♦ Plan and/or conduct an investigation about equal and opposite forces in collisions to produce data/observations to serve as evidence ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about forces that allow objects to interact even when they do not touch (e.g., magnetic, gravitational, electrical forces) ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about how changes in mass and/or changes in applied force effect the change in speed of an object ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the presence or absence of electrical and/or magnetic fields (e.g. orientation of iron filings in magnetic fields, attraction/repulsion of charged objects in electric fields) ♦ Test two different models of the same proposed design solution related to the forces in collisions to determine which better meets criteria for success	**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the equal and opposite forces in collisions. ♦ Organize simple data sets to reveal patterns about the results of balanced and unbalanced forces applied to an object ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about the presence/absence of electric and/or magnetic fields. ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) about how changes in mass and/or changes in applied force effect the change in speed of an object	**6. Constructing explanations (cont.)** ♦ Explain the relationship between very large masses and gravitational fields ♦ Explain the relationship between distance and the strength of fields (i.e., electric, magnetic, gravitational) ♦ Use observations and data from investigations to design a solution to a problem related to reducing the forces on both objects in a collision **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about the presence/absence of a field in a given scenario ♦ Compare and critique two arguments about how mass and/or applied force affect the change in speed of an object ♦ Defend a claim about the merit of a design solution about reducing the forces on both objects in a collision by citing relevant evidence (e.g., force readings in collisions, damage analysis) **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain how fields (i.e. electric, magnetic, gravitational) apply forces to objects without touching them

ENTRY POINTS to Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about Newton's 1st, 2nd, and/or 3rd Law of Motion ♦ Research and present information about the direction and strength (e.g., when mass or distance is changed) of gravitational fields
Energy	**1. Asking questions/defining problems** ♦ Identify scientific (testable) and non-scientific (non-testable) questions about the relationship between kinetic energy and mass and/or speed ♦ Ask questions about what would happen if a variable was changed in an investigation about kinetic energy (e.g., height of a slope, mass of a cart) ♦ Ask questions about what would happen if a variable was changed in an investigation about thermal energy transfer (e.g., different types of insulating materials, different liquids) ♦ Generate scientific questions about convection, conduction, and/or radiation ♦ Use prior knowledge to describe problems that can be solved using conduction, convection, and/or radiation ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a problem related to thermal energy transfer	**3. Analyzing and interpreting data** ♦ Use observations and/or data from an investigation to determine the direction of thermal energy transfer ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the relationship between kinetic energy, mass, and speed ♦ Analyze and interpret data to make sense of how thermal energy transfers from hotter to colder regions through convection, conduction, and/or radiation ♦ Compare and contrast data showing the kinetic and gravitational potential energy at different points in a system (e.g., roller coaster, slope, falling object) ♦ Use observations and/or data to evaluate and/or refine design solutions related to maximizing or minimizing thermal energy transfer	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain how potential energy is converted to kinetic energy (e.g., a flexed bow before and after releasing an arrow) ♦ Develop, revise, and/or use a model to show/explain that heat transfers from warmer regions to cooler regions ♦ Develop, revise, and/or use a model to show/explain how radiated heat from a nearby source decreases with distance from the source ♦ Develop, revise, and/or use a model to show/explain the process of convection, conduction, and/or radiation ♦ Develop, revise, and/or use a model to show/explain the relationship between the kinetic energy of particles and the temperature of a substance ♦ Develop, revise, and/or use a model to show/explain how changing the relative position of an object can change the potential energy of the object (e.g., in gravitational, magnetic, or electric fields)

ENTRY POINTS to Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)	**1. Asking questions/defining problems** ♦ Generate scientific questions about potential energy (e.g., electric, magnetic, gravitational) based on research and/or observations **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about thermal energy transfer to produce data/observations to serve as evidence ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about thermal energy transfer ♦ Test two different models of the same proposed design solution related to thermal energy transfer to determine which better meets criteria for success ♦ Plan and/or conduct an investigation about gravitational potential energy and kinetic energy transfer to produce data/observations to serve as evidence (e.g., roller coaster, slope, falling object) ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the relationship between kinetic energy, mass, and speed	**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the direction of thermal energy transfer ♦ Construct and interpret graphs to determine the relationship between the temperature change of a substance and the thermal energy added or removed from the substance ♦ Organize simple data sets to reveal patterns about the relationship between kinetic energy, mass, and/or speed ♦ Organize simple data sets to reveal patterns about the kinetic and gravitational potential energy in a system ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about conduction, convection, and/or radiation (e.g., Which materials allow more heat to radiate using a temperature gauge? Describe the movement of food coloring in different water temperatures) ♦ Construct and interpret graphs to determine the relationship between kinetic energy vs. speed ♦ Construct and interpret graphs to determine the relationship between kinetic energy vs. mass ♦ Construct and interpret graphs to determine the relationship between thermal energy transfer vs. temperature/average kinetic energy of particles ♦ Construct and interpret graphs to determine the relationship between gravitational potential energy vs. mass	**6. Constructing explanations** ♦ Explain the relationship between kinetic energy and mass and/or kinetic energy and speed ♦ Explain how kinetic energy is transferred from an object when it strikes or collides with another object (e.g., bowling ball striking pins, particles colliding) ♦ Explain the relationship between the potential energy and kinetic energy in a system (e.g., roller coaster, slope, falling object) ♦ Explain the relationship between the relative positions of objects in a gravitational field and their relative potential energy (e.g., comparing the potential energy of objects at different heights) ♦ Explain how energy is transferred through the process of convection, conduction, and/or radiation ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about the most effective materials for maximizing or minimizing thermal energy transfer ♦ Generate and compare multiple solutions to a problem related to maximizing or minimizing thermal energy transfer **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about the direction of thermal energy transfer

ENTRY POINTS to
Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)			**7. Engaging in argument from evidence (cont.)** ♦ Use scientific evidence and observations to construct an argument about kinetic energy transfer in collisions ♦ Defend a claim about the merit of a design solution about minimizing or maximizing thermal energy transfer by citing relevant evidence (e.g. data from investigations, prototype testing) **8. Obtaining, evaluating, and Communicating information** ♦ Research and present information about how changing the relative position of an object can change the potential energy of the object (e.g., in gravitational, magnetic, or electric fields) ♦ Research and present information about how energy can change from potential to kinetic and vice versa ♦ Combine scientific information from multiple sources to explain the relative effectiveness of materials to retain and/or radiate heat ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the relationship between kinetic energy and the mass and speed of an object

ENTRY POINTS to Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer	**1. Asking questions/defining problems** ♦ Identify scientific (testable) and non-scientific (non-testable) questions about light and/or mechanical waves ♦ Generate scientific questions about the repeating patterns of waves based on research and/or observations ♦ Generate scientific questions about light and/or mechanical waves based on research and/or observations ♦ Use prior knowledge to describe problems that can be solved using a code to transmit information ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a problem related to transmitting information using a code and/or technology **2. Planning and carrying out investigations** ♦ Plan and/or conduct an investigation about the behavior of mechanical waves to produce data/observations to serve as evidence ♦ Select and use appropriate methods and/or tools for collecting data in an investigation about the reflection, absorption, and transmission of light waves ♦ Record observations and/or measurements to produce data to serve as evidence for investigations about the components of a repeating wave pattern (e.g., amplitude, frequency, wavelength)	**3. Analyzing and interpreting data** ♦ Use observations and/or data from an investigation to determine the types of materials that absorb, reflect, and transmit light and/or mechanical waves ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the amplitude and energy of waves ♦ Analyze and interpret data to make sense of the repeating pattern of waves (e.g., frequency and wavelength are maintained) ♦ Compare and contrast data showing the characteristics of different waves (e.g., amplitude, frequency, wavelength) **4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the characteristics of waves (e.g., amplitude, energy, frequency) ♦ Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about the reflection, absorption, and transmission of light and/or mechanical waves ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) about the energy of light and/or mechanical waves	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain a repeating wave pattern showing amplitude, frequency, and wavelength ♦ Develop, revise, and/or use a model to show/explain how light rays are reflected, absorbed, or transmitted through a solid, liquid, or gas ♦ Develop, revise, and/or use a model to show/explain how sound waves are reflected, absorbed, or transmitted through a solid, liquid or gas ♦ Develop, revise, and/or use a model to show/explain how digitized signals (e.g., 0s and 1s transmitted by waves) can be used to encode and decode information **6. Constructing explanations** ♦ Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about the differences and similarities between light and mechanical waves ♦ Explain how waves can be reflected, absorbed, and/or transmitted through a material ♦ Explain the relationship between the amplitude of a wave and the wave's energy ♦ Explain how a pattern of 1s and 0s sent through a digitized signal could be decoded into information

ENTRY POINTS to Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Tech-nologies for Information Transfer (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Test two different models of the same proposed design solution related to transmitting information using a code to determine which better meets criteria for success		**7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about which materials best reflect, absorb, or transmit light and/or sound ♦ Compare and critique two arguments about why some waves need a material through which to be transmitted and others do not ♦ Defend a claim about the merit of a design solution about transmitting information using a digitized signal by citing relevant evidence **8. Obtaining, evaluating, and communicating information** ♦ Combine scientific information from multiple sources to explain the characteristics of repeating wave patterns ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the reflection, transmission, and absorption of light and/or mechanical waves ♦ Research and present information about how digitized signals can be used to encode and transmit information

Science and Technology/Engineering
Pre-K–Grade 8

TECHNOLOGY/ENGINEERING

Core Idea	Access Skills	Grades 1–2	Grades 3–5	Grades 6–8
Engineering Design	Pages 152–153	Pages 150–151, 159–160	Pages 161–162, 164–165	Pages 168–169, 172–173
Materials, Tools, and Manufacturing	Pages 153–155			Pages 168, 171, 174–176
Technological Systems	Pages 155–158		Pages 163, 165–167	Pages 169–170, 177–179

Grade Level: Grade 1

Core Idea	Learning Standards as written	
Engineering Design	**1.K-2-ETS1-1**	Ask questions, make observations, and gather information about a situation people want to change that can be solved by developing or improving an object or tool. *
	1.K-2-ETS1-2	Generate multiple solutions to a design problem and make a drawing (plan) to represent one or more of the solutions. *

Grade Level: Grade 2

Core Idea	Learning Standards as written	
Engineering Design	**2.K-2-ETS1-3**	Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs. * Clarification Statements: ♦ Data can include observations and be either qualitative or quantitative. ♦ Examples can include how different objects insulate cold water or how different types of grocery bags perform.

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design	**1. Asking questions/defining problems** ♦ Explore materials representing the solution(s) to a design problem visually or by touch (Specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing the solution(s) to a design problem within a specified amount of time of the activity being interrupted ♦ Gain attention to explore materials representing the solution(s) to a design problem within a specified time block(s) ♦ Make a request to explore materials representing the solution(s) to a design problem within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of materials related to the solution(s) to a design problem ♦ Match object to object, object to picture, or picture to picture of materials used in the solution(s) to a design problem **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in the solution(s) to a design problem investigation within a specified time block(s) ♦ Release or give materials in the solution(s) to a design problem within a specified amount of time of the directive ♦ Turn on/off technology in the solution(s) to a design problem investigation within a specified amount of time of the directive	**3. Analyzing and interpreting data** ♦ Track materials representing solution(s) to a simple design problem activity in the creation of a table, chart, or graph ♦ Orient or manipulate materials representing solution(s) to a simple design problem activity in the creation of a table, chart, or graph ♦ Functionally use materials representing solution(s) to a simple design problem activity in the creation of a table, chart, or graph ♦ Locate objects partially hidden or out of sight representing solution(s) to a simple design problem activity in the creation of a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph in a model representing the solution(s) to a simple design problem activity (e.g., glue stick to adhere materials to graph) **4. Using mathematics and computational thinking** ♦ Grasp (hold) materials related to a solution(s) to a simple design problem for a specified amount of time in a comparison activity ♦ Release or give materials related to a solution(s) to a simple design problem within a specified amount of time in a comparison activity ♦ Turn on/off technology related to a solution(s) to a simple design problem within a specified amount of time in a comparison activity	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) materials used to create possible solution(s) to a simple design problem model ♦ Orient or manipulate Materials used to create possible solution(s) to a simple design problem model ♦ Functionally use materials in a model related to the solution(s) to a simple design problem ♦ Locate objects partially hidden or out of sight in a model representing the solution(s) to a simple design problem ♦ Construct or assemble a model representing the solution(s) to a simple design problem (Specify criteria) ♦ Use one object to act on another in to a simple design problem solution(s) model (e.g., use a pointer to tap) **6. Constructing explanations** ♦ Grasp (hold) materials for a specified amount of time, in the creation of a written product to explain the elements of a design solution **7. Engaging in argument from evidence** ♦ Release or give materials within a specified amount of time, in the creation of a written product, to defend a claim about the merits of a design solution (i.e., modifications/improvements)

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Move materials in the solution(s) to a design problem investigation ♦ Use two hands in the solution(s) to a design problem investigation ♦ Imitate action in the solution(s) to a design problem investigation ♦ Initiate cause and effect response in the solution(s) to a design problem investigation within a specified amount of time of the directive	**4. Using mathematics and computational thinking (cont.)** ♦ Move materials related to a solution(s) to a simple design problem in a comparison activity ♦ Use two hands to manipulate materials related to a solution(s) to a simple design problem in a comparison activity ♦ Imitate action related to a solution(s) to a simple design problem in a comparison activity ♦ Initiate cause and effect response related to a solution(s) to a simple design problem within a specified time block(s) in a comparison activity	**8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing the solution(s) to a simple design problem ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing the solution(s) to a simple design problem ♦ Move or functionally use materials to communicate ideas/information representing the solution(s) to a simple design problem (e.g., Voice Output, Switch, low tech) ♦ Choose materials within a specified amount of time from an errorless array of representing the solution(s) to a simple design problem ♦ Match object to object, or object to picture, or picture to picture of materials representing the solution(s) to a simple design problem
Materials, Tools, and Manufac-turing	**1. Asking questions/defining problems** ♦ Explore visually or tactilely tools and materials necessary to create a prototype (specify accuracy criteria) ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing tools and materials necessary to create a prototype (specify accuracy criteria) within a specified time block(s)	**3. Analyzing and interpreting data** ♦ Grasp (hold) materials necessary to create a prototype for a specified amount of time in a comparison activity (e.g. different materials, varied properties) ♦ Grasp (hold) tools necessary to create a prototype for a specified amount of time in a comparison activity (e.g. measuring tools, hand tools)	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) tools and materials necessary to create a prototype model ♦ Orient or manipulate tools and materials necessary to create a prototype model ♦ Functionally use materials related to the tools and materials necessary to create a prototype in a model

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Materials, Tools, and Manufacturing (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Gain attention to explore materials representing tools and materials necessary to create a prototype (specify accuracy criteria) ♦ Make a request to explore materials representing tools and materials necessary to create a prototype within a specified time block(s) ♦ Choose within a specified amount of time from an errorless array of materials related to tools and materials necessary to create a prototype ♦ Match object to object, or object to picture, or picture to picture of tools and materials needed to create a prototype ♦ Turn on/off technology, within a specified amount of time of the directive, to determine scientific and non-scientific questions about the material used in a design solution **2. Planning and carrying out investigations** ♦ Grasp (hold) tools and materials necessary to create a prototype investigation for a specified amount of time ♦ Release or give tools and materials necessary to create a prototype within a specified amount of time of the directive ♦ Turn on/off technology to create a prototype investigation within a specified amount of time of the directive	**3. Analyzing and interpreting data (cont.)** ♦ Release or give tools and materials necessary to create a prototype within a specified amount of time in a comparison activity ♦ Turn on/off technology related to tools and materials necessary to create a prototype within a specified amount of time in a comparison activity ♦ Move tools and materials necessary to create a prototype in a comparison activity ♦ Use two hands to manipulate tools and materials necessary to create a prototype in a comparison activity ♦ Imitate action using tools and materials necessary to create a prototype in a comparison activity ♦ Initiate cause and effect using tools and materials necessary to create a prototype within a specified time block(s) in a comparison activity **4. Using mathematics and computational thinking** ♦ Track tools and materials necessary in the creation of a table, chart, or graph ♦ Orient or manipulate tools and materials to create a table, chart, or graph ♦ Functionally use tools and materials to create a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph representing tools and materials necessary to create a prototype	**5. Developing and using models (cont.)** ♦ Locate partially hidden or out of sight tools and materials that are necessary to create a prototype model ♦ Use one object to act on another to create a prototype in a model (e.g., use a pointer to tap) **6. Constructing explanations** ♦ Move materials related to the creation of a written product that describes a design solution to a simple design problem ♦ Use one object to act on another in the creation of a written product that describes a design solution to a simple design problem (e.g., glue stick to adhere materials of the design solution) **7. Engaging in argument from evidence** ♦ Choose from an array of errorless choices (within a specified amount of time) in support of an argument about the best design solution for a problem **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing the tools and materials necessary to create a prototype ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing the tools and materials necessary to create a prototype

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Materials, Tools, and Manufacturing (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Turn on/off technology (video) for an investigation of the manufacturing process within a specified amount of time of the directive ♦ Move tools and materials necessary to create a prototype investigation ♦ Use two hands in a tools and materials necessary to create a prototype investigation ♦ Imitate action in a tools and materials necessary to create a prototype investigation ♦ Initiate cause and effect response in a tools and materials necessary to create a prototype investigation		**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Move or functionally use materials to communicate ideas/information representing the tools and materials necessary to create a prototype (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing the tools and materials necessary to create a prototype ♦ Match object to object, or object to picture, or picture to picture for tools and materials necessary to create a prototype
Technological Systems	**1. Asking questions/defining problems** ♦ Explore materials representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, visually or by touch for a specified amount of time ♦ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, for a specified amount of time	**3. Analyzing and interpreting data** ♦ Track materials in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems activity to create a table, chart, or graph ♦ Orient or manipulate materials in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems activity to create a table, chart, or graph	**5. Developing and using models** ♦ Track (shift focus from materials to speaker) in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, model ♦ Orient or manipulate a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, model ♦ Functionally use materials related to the communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, in a model

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)	**1. Asking questions/defining problems** ♦ Gain attention to explore materials representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, within a specified time block(s) ♦ Make a request to explore materials representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems within a specified time block(s) ♦ Choose, within a specified amount of time, from an errorless array to explore materials related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems ♦ Match object to object, or object to picture, or picture to picture in a communication (radio, television, print, AAC), transportation (car, boat, plane), or structural (foundation, decking, wall, roof) systems investigation **2. Planning and carrying out investigations** ♦ Grasp (hold) materials in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, investigation for a specified amount of time	**3. Analyzing and interpreting data (cont.)** ♦ Functionally use materials in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems activity to create a table, chart, or graph ♦ Locate objects partially hidden or out of sight regarding communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems activity to create a table, chart, or graph ♦ Use one object to act on another in the creation of a table, chart, or graph in a model representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems (e.g., glue stick to adhere materials to graph) **4. Using mathematics and computational thinking** ♦ Grasp (hold) materials related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems for a specified amount of time in a comparison activity	**5. Developing and using models (cont.)** ♦ Locate objects partially hidden or out of sight in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, model ♦ Construct or assemble communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, model ♦ Use one object to act on another in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, in a model (e.g., use a pointer to tap) **6. Constructing explanations** ♦ Construct or assemble materials related to the creation of a written product that explains problem or solution related to the transportation system (car, boat, plane) ♦ Functionally use materials to create a written product to explain problems related to communication systems (e.g. radio, television, print, AAC) **7. Engaging in argument from evidence** ♦ Release or give materials within a specific amount of time to create a written document to make an argument/claim in support of the optimal mode of communication for a specific purpose

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)	**2. Planning and carrying out investigations** ♦ Release or give materials in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems investigation within a specified time ♦ Turn on/off technology in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, investigation within a specified time of time ♦ Move materials in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, investigation ♦ Use two hands in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, investigation ♦ Imitate action in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, investigation ♦ Initiate cause and effect response in a communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems, investigation within a specified time block(s)	**4. Using mathematics and computational thinking (cont.)** ♦ Release or give materials related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems within a specified amount of time in a comparison activity ♦ Turn on/off technology related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems within a specified amount of time in a comparison activity ♦ Move materials related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems in a comparison activity ♦ Use two hands to manipulate materials related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems in a comparison activity ♦ Imitate action related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems in a comparison activity	**7. Engaging in argument from evidence (cont.)** ♦ Orient or manipulate materials to create a written document to make an argument/claim in support of the optimal mode of transportation for a specific purpose **8. Obtaining, evaluating, and communicating information** ♦ Track materials to communicate ideas/information representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems ♦ Grasp, release or give materials to another person within a specified amount of time to communicate ideas/information representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems ♦ Move or functionally use materials to communicate ideas/information representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems (e.g., Voice Output, Switch, low tech) ♦ Choose within a specified amount of time from an errorless array of materials representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems

ACCESS SKILLS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)		**4. Using mathematics and computational thinking (cont.)** ♦ Initiate cause and effect response related to communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems within a specified time block(s) in a comparison activity	**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Match object to object, or object to picture, or picture to picture of materials representing communication (radio, television, print, AAC), transportation (car, boat, plane) or structural (foundation, decking, wall, roof) systems

ENTRY POINTS to Technology/Engineering Standards in Grades 1–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design	**1. Asking questions/defining problems** ♦ Record relevant questions about a simple design problem or design solution based on observations. ♦ Ask relevant questions based on observations about a simple design problem or design solution ♦ Identify questions that can be answered by testing a design solution ♦ Define a simple design problem based on observations and/or firsthand experiences of an object or tool **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about a simple design problem or design solution ♦ Record observations (e.g., firsthand experiences, media) to collect data on a simple design problem or design solution ♦ Use pictures and/or drawings to collect observations on a simple design problem or design solution	**3. Analyzing and interpreting data** ♦ Group information/data about a simple design problem or design solution to identify patterns. ♦ Compare predictions to the data and/or observations from the test of a design solution to a simple design problem ♦ Display data using a simple graph or picture to show information about a simple design problem or design solution ♦ Compare the data from tests of two objects designed to solve the same design problem **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about a simple design problem or design solution ♦ Identify the qualitative and quantitative information about a simple design problem or design solution ♦ Identify the qualitative and quantitative information from tests of two objects designed to solve the same design problem	**5. Developing and using models** ♦ Illustrate, construct, and/or label a model to show/explain a simple design problem or design solution ♦ Distinguish between a model of a solution and the actual design solution ♦ Compare models of two design solutions to determine the strengths and weaknesses of how each object performs **6. Constructing explanations** ♦ Describe a design solution to a simple design problem ♦ Identify observations that match descriptions about a simple design problem or design solution ♦ Generate a design solution to a problem using pictures or drawings **7. Engaging in argument from evidence** ♦ Use scientific evidence in support of an argument about the best design solution for a problem **8. Obtaining, evaluating, and communicating information** ♦ Research and present information about a simple design problem or design solution ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas a simple design problem or design solution ♦ Compare fiction and non-fiction resources describing a design problem or a design solution

ENTRY POINTS to Technology/Engineering Standards in Grades 1–2

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design (cont.)			**8. Obtaining, evaluating, and communicating information (con t.)** ♦ Recall important information about a simple design problem or design solution from a text or media source

Grade Level: Grade 3

Core Idea	Learning Standards as written	
Engineering Design	**3.3-5-ETS1-1**	Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet. *
	3.3-5-ETS1-2	Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem. * Clarification Statement: ♦ Examples of design problems can include adapting a switch on a toy for children who have a motor coordination disability, designing a way to clear or collect debris or trash from a storm drain, or creating safe moveable playground equipment for a new recess game.
	3.3-5-ETS1-4(MA)	Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution. * Clarification Statements: ♦ Examples of informational resources can include books, videos, and websites. ♦ Examples of representations can include graphic organizers, sketches, models, and prototypes.

Grade Level: Grade 4

Core Idea	Learning Standards as written	
Engineering Design	**4.3-5-ETS1-3**	Plan and carry out tests of one or more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of tests to redesign a model or prototype. * Clarification Statement: ♦ Examples of design features can include materials, size, shape, and weight.
	4.3-5-ETS1-5(MA)	Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem. *

Grade Level: Grade 5

Core Idea	Learning Standards as written	
Techno-logical Systems	**5.3-5-ETS3-1(MA)**	Use informational text to provide examples of improvements to existing technologies (innovations) and the development of new technologies (inventions). Recognize that technology is any modification of the natural or designed world done to fulfill human needs or wants.
	5.3-5-ETS3-2(MA)	Use sketches or drawings to show how each part of a product or device relates to other parts in the product or device. *

ENTRY POINTS to Technology/Engineering Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask a question about a design problem or a proposed solution ♦ Identify questions that can be answered by testing a design solution ♦ Define a simple design problem that can be solved ♦ Identify challenges and criteria for success for a simple design problem such as materials, time, or cost **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about a simple design problem or a design solution ♦ Select the best method to collect data and/or observations about a simple design problem or a design solution ♦ Record observations (e.g., firsthand experiences, media) to collect data related on a simple design problem or a design solution	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from a test of a design solution (e.g., testing a prototype) ♦ Use data and/or observations to identify patterns of a design problem or design solution ♦ Use data and/or observations to identify relationships between the needs of a design problem and a proposed design solution ♦ Evaluate data and/or observations from tests of an object or tool designed to solve a problem to determine if it works as intended. ♦ Display data using a simple graph to show the results of testing a design solution ♦ Draw conclusions based on evidence (e.g., from an investigation) about the validity of a design solution **4. Using mathematics and computational thinking** ♦ Use counting and numbers to show data about a simple design problem or a design solution ♦ Identify patterns in quantitative data about a simple design problem or a design solution (e.g., time, cost) ♦ Describe, measure, and/or compare quantitative attributes of design solutions ♦ Identify the qualitative and quantitative information about a simple design problem or a design solution (e.g., materials, time, cost	**5. Developing and using models** ♦ Illustrate and/or develop a model to show/explain a simple design problem or design solution ♦ Distinguish between a model of a design solution and an actual design solution (e.g., a prototype vs. a final design) ♦ Compare models of design solutions to identify common features and differences ♦ Compare list of materials used in a model to identify common features and differences **6. Constructing explanations** ♦ Describe a design solution to a simple design problem ♦ Describe the relationship between a problem and it's intended solution ♦ Explain a design solution to a simple design problem ♦ Use tools and/or materials to build a device that solves a specific design problem ♦ Draw and/or explain a design solution ♦ Generate and/or compare multiple solutions to a problem **7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim about the solution that best fits the needs of a problem ♦ Use scientific evidence to support a claim for or against a design solution **8. Obtaining, evaluating, and communicating information** ♦ Research and present information about a simple design problem or a design solution

ENTRY POINTS to Technology/Engineering Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas related to a simple design problem or a design solution ♦ Compare two informational sources to determine similarities and differences in how they present information about a simple design problem
Techno-logical Systems	**1. Asking questions/defining problems** ♦ Use observations and/or data to ask a question about a design problem or a proposed solution related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Identify questions that can be answered by testing a design solution related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Define a simple design problem that can be solved related to fulfilling a human need or want	**3. Analyzing and interpreting data** ♦ Compare predictions to the data and/or observations from an test of a design solution (e.g., testing a prototype) related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Use data and/or observations to identify relationships between the needs of a design problem and a proposed design solution related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Display data using a simple graph to show patterns related to defining a human need or want related to an existing problem ♦ Draw conclusions based on evidence (e.g., from an investigation) about the validity of a design solution related to improving an existing technology (innovation) or developing new technologies (invention)	**5. Developing and using models** ♦ Illustrate and/or develop a model to show/explain a simple design problem or design solution related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Illustrate and/or develop a model to show/explain how the parts of a product/device interact with each other (e.g., hinges on a door, spring system in a windup car) ♦ Compare models of design solutions related to fulfilling a human need or want to identify common features and differences **6. Constructing explanations** ♦ Describe a design solution to a simple design problem related to improving an existing technology (innovation) or developing new technologies (invention)

ENTRY POINTS to Technology/Engineering Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data and/or observations about a simple design problem or a design solution related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Select the best method to collect data and/or observations about a simple design problem or a design solution related to fulfilling a human need or want ♦ Select the best method to collect data and/or observations about how each part of a product/device relates to each other ♦ Record observations (e.g., firsthand experiences, media) to collect data related on a simple design problem or a design solution related to improving an existing technology (innovation) or developing new technologies (invention)	**4. Using mathematics and computational thinking** ♦ Identify patterns in quantitative data about a simple design problem or a design solution related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Describe, measure, and/or compare quantitative attributes of design solutions related to improving an existing technology (innovation) or developing new technologies (invention) ♦ Identify the qualitative and quantitative information about a simple design problem or a design solution related to defining a human need or want related to an existing problem	**6. Constructing explanations (cont.)** ♦ Explain a design solution to a simple design problem related to fulfilling a human need or want ♦ Draw and/or explain a design solution for how parts of a product/device interact with each other ♦ Generate and/or compare multiple solutions to a problem related to improving an existing technology (innovation) or developing new technologies (invention) **7. Engaging in argument from evidence** ♦ Use scientific evidence to support a claim about the solution that best fits the needs of a problem related to fulfilling a human need or want ♦ Use scientific evidence to support a claim for or against a design solution about improving an existing technology (innovation) or developing new technologies (invention) ♦ Use scientific evidence to support a claim about how parts of a product/device interact with each other **8. Obtaining, evaluating, and communicating information** ♦ Research and present information about a simple design problem or a design solution related to improving an existing technology (innovation) or developing new technologies (invention)

ENTRY POINTS to Technology/Engineering Standards in Grades 3–5

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas a simple design problem or a design solution related to fulfilling a human need or want ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas about how parts of a product/device interact with each other ♦ Compare two informational sources to determine similarities and differences in how they present information about a simple design problem related to improving an existing technology (innovation) or developing new technologies (invention)

Grade Level: Grade 6

Core Idea	Learning Standards as written	
Engineering Design	**6.MS-ETS1-1**	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution. Include potential impacts on people and the natural environment that may limit possible solutions. *
	6.MS-ETS1-5(MA)	Create visual representations of solutions to a design problem. Accurately interpret and apply scale and proportion to visual representations. * Clarification Statements: ♦ Examples of visual representations can include sketches, scaled drawings, and orthographic projections. ♦ Examples of scale can include ¼″ = 1′0″ and 1 cm = 1 m.
	6.MS-ETS1-6(MA)	Communicate a design solution to an intended user, including design features and limitations of the solution. Clarification Statement: ♦ Examples of intended users can include students, parents, teachers, manufacturing personnel, engineers, and customers.
Materials, Tools, and Manu-facturing	**6.MS-ETS2-1(MA)**	Analyze and compare properties of metals, plastics, wood, and ceramics, including flexibility, ductility, hardness, thermal conductivity, electrical conductivity, and melting point.
	6.MS-ETS2-2(MA)	Given a design task, select appropriate materials based on specific properties needed in the construction of a solution. * Clarification Statement: ♦ Examples of materials can include metals, plastics, wood, and ceramics.
	6.MS-ETS2-3(MA)	Choose and safely use appropriate measuring tools, hand tools, fasteners, and common hand-held power tools used to construct a prototype. * Clarification Statements: ♦ Examples of measuring tools include a tape measure, a meter stick, and a ruler. ♦ Examples of hand tools include a hammer, a screwdriver, a wrench, and pliers. ♦ Examples of fasteners include nails, screws, nuts and bolts, staples, glue, and tape. ♦ Examples of common power tools include jigsaw, drill, and sander.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
Engineering Design	**7.MS-ETS1-2**	Evaluate competing solutions to a given design problem using a decision matrix to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution. *
	7.MS-ETS1-4	Generate and analyze data from iterative testing and modification of a proposed object, tool, or process to optimize the object, tool, or process for its intended purpose. *
	7.MS-ETS1-7(MA)	Construct a prototype of a solution to a given design problem. *
Techno-logical Systems	**7.MS-ETS3-1(MA)**	Explain the function of a communication system and the role of its components, including a source, encoder, transmitter, receiver, decoder, and storage.
	7.MS-ETS3-2(MA)	Compare the benefits and drawbacks of different communication systems. Clarification Statements: ♦ Examples of communications systems can include radio, television, print, and Internet. ♦ Examples of benefits and drawbacks can include speed of communication, distance or range, number of people reached, audio only vs. audio and visual, and one-way vs. two-way communication.
	7.MS-ETS3-3(MA)	Research and communicate information about how transportation systems are designed to move people and goods using a variety of vehicles and devices. Identify and describe subsystems of a transportation vehicle, including structural, propulsion, guidance, suspension, and control subsystems. Clarification Statements: ♦ Examples of design elements include vehicle shape to maximize cargo or passenger capacity, terminals, travel lanes, and communications/controls. ♦ Examples of vehicles can include a car, sailboat, and small airplane.

Grade Level: Grade 7

Core Idea	Learning Standards as written	
Techno-logical Systems (cont.)	**7.MS-ETS3-4(MA)**	Show how the components of a structural system work together to serve a structural function. Provide examples of physical structures and relate their design to their intended use. Clarification Statements: ♦ Examples of components of a structural system could include foundation, decking, wall, and roofing. ♦ Explanations of function should include identification of live vs. dead loads and forces of tension, torsion, compression, and shear. ♦ Examples of uses include carrying loads and forces across a span (such as a bridge), providing livable space (such as a house or office building), and providing specific environmental conditions (such as a greenhouse or cold storage).
	7.MS-ETS3-5(MA)	Use the concept of systems engineering to model inputs, processes, outputs, and feedback among components of transportation, structural, or communication system.

Grade Level: Grade 8

Core Idea	Learning Standards as written	
Materials, Tools, and Manu-facturing	**8.MS-ETS2-4(MA)**	Use informational text to illustrate that materials maintain their composition under various kinds of physical processing; however, some material properties may change if a process changes the particulate structure of a material. Clarification Statements: ♦ Examples of physical processing can include cutting, forming, extruding, and sanding. ♦ Examples of changes in material properties can include a non-magnetic iron material becoming magnetic after hammering and a plastic material becoming rigid (less elastic) after heat treatment.
	8.MS-ETS2-5(MA)	Present information that illustrates how a product can be created using basic processes in manufacturing systems, including forming, separating, conditioning, assembling, finishing, quality control, and safety. Compare the advantages and disadvantages of human vs. computer control of these processes.

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in a test of a prototype related to a design problem ♦ Identify scientific (testable) and non-scientific (non-testable) questions about a solution to a design problem ♦ Use prior knowledge to describe design problems that can be solved ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a design problem ♦ Generate scientific questions about a design problem based on research and/or observations **2. Planning and carrying out investigations** ♦ Plan and/or conduct a test of a design solution to produce data to serve as evidence for the validity of the solution ♦ Select and use appropriate methods and/or tools for collecting data about a problem or a design solution ♦ Record observations and/or measurements to produce data to serve as evidence for a problem or a design solution ♦ Test two different models of the same proposed design solution to determine which better meets criteria for success.	**3. Analyzing and interpreting data** ♦ Use observations and/or data (e.g., from prototype testing) to determine the criteria/constraints of a design problem such as size, shape, weight, or cost ♦ Use observations and/or data (e.g., from prototype testing) to determine the validity of a design solution such as size, shape, weight, or cost ♦ Represent data visually (e.g., decision matrix, bar graphs, pictographs, and/or pie charts) to reveal patterns about the successes and failures of a design solution ♦ Represent data visually (e.g., decision matrix, bar graphs, pictographs, and/or pie charts) to reveal patterns about the criteria/constraints of a design problem ♦ Analyze and interpret data to make sense of the successes and failures of a design solution ♦ Analyze and interpret data to make sense of the criteria/constraints of a design problem ♦ Compare and contrast the result of a design solution to the criteria/constraints of the design problem ♦ Use observations and/or data to evaluate and/or refine design solutions	**5. Developing and using models** ♦ Develop, revise, and or use a model to show/explain a problem or design solution **6. Constructing explanations** ♦ Explain the criteria/constraints of a problem (e.g., potential impacts on people and the environment) ♦ Explain the elements of a design solution ♦ Explain the relationship between the criteria/constraints of a problem and a design solution ♦ Draw conclusions based on multiple pieces of evidence (e.g., from prototype testing) about the effectiveness of a design solution ♦ Generate and compare multiple solutions to a problem ♦ Use observations and data from investigations to design a solution to a problem **7. Engaging in argument from evidence** ♦ Use scientific evidence to support an argument about the solution that best fits a problem's criteria/constraints ♦ Compare and critique two arguments about the solution that best fits a problem's criteria/constraints ♦ Defend a claim about the merit of a design solution by citing relevant evidence (e.g. size, shape, weight, cost, potential impacts on people and the environment)

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design (cont.)		**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about a problem or a design solution ♦ Evaluate if qualitative or quantitative data is best to collect as evidence when defining a problem or testing a design solution ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., size, shape, weight, cost) to establish evidence defining a problem or evaluating a design solution ♦ Use scale and proportion in diagrams (e.g., scale drawings) representing design solutions	**8. Obtaining, evaluating, and communicating information** ♦ Research and present information about the criteria/constraints of a design problem or a design solution ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas about the criteria/constraints of a design problem or a design solution ♦ Combine scientific information from multiple sources to explain the criteria/constraints of a design problem or a design solution

Design Problem = a problem with an object tool or process based on observations and/or data

Design Solution = a proposed modification/improvement to an object tool or process, or a new object tool or process, that meets the needs of a design problem

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Materials, Tools, and Manufac-turing	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a material (e.g., metals, plastics, wood, ceramic) was changed in a test of a prototype related to a design problem ♦ Identify scientific (testable) and non-scientific (non-testable) questions about the materials (e.g., metals, plastics, wood, ceramic) used in a design solution ♦ Use prior knowledge to describe design problems that can be solved using hand tools and/or power tools ♦ Use prior knowledge to describe design problems that can be solved using basic manufacturing processes (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety) ♦ Determine several constraints of materials when defining a design problem ♦ Generate scientific questions based on research and/or observations about the human control vs. computer control of a manufacturing process (e.g., automated assembly line vs human built) **2. Planning and carrying out investigations** ♦ Plan and/or conduct a test of a design solution using different types of materials (e.g., metals, plastics, wood, ceramic) to produce data to serve as evidence	**3. Analyzing and interpreting data** ♦ Use observations and/or data to determine the most appropriate tool (e.g., hand tool, power tool) for constructing a prototype ♦ Use observations and/or data (e.g., from prototype testing) to determine the validity of the use of a material (e.g., metals, plastics, wood, ceramic) in a design solution ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the successes and failures of a design solution constructed with different materials ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the criteria/constraints of a design problem related to the physical processing of materials ♦ Analyze and interpret data to make sense of the successes and failures of computer control of a process ♦ Compare and contrast the result of a design solution to the criteria/constraints of the design problem that requires the evaluation of materials ♦ Use observations and/or data to evaluate and/or refine design solutions using basic manufacturing processes (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety)	**5. Developing and using models** ♦ Develop, revise, and/or use a model (e.g., design sketch, prototype) to show/explain the materials used in a design solution and their properties ♦ Develop, revise, and/or use a model to show/explain how materials processing (e.g., cutting, forming, extruding, sanding) may or may not change the property of the material ♦ Develop, revise, and/or use a model to show/explain the basic manufacturing processes (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety) for creating a product ♦ Develop, revise, and/or use a model to compare the advantages and disadvantages of human control vs. computer control of a process **6. Constructing explanations** ♦ Explain the constraints of using measuring tools, hand tools, fasteners, and/or power tools for defining a problem or constructing a solution ♦ Explain why a specific material was selected to accomplish a design task based on the material's properties (e.g., weight, strength, hardness, flexibility) ♦ Explain the elements of the manufacturing processes (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety) for a design solution

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Materials, Tools, and Manufacturing (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Plan and/or conduct a test of different kinds of physical processing (e.g., cutting, forming, extruding, sanding) to produce data to serve as evidence for which processing should be used for a design solution ♦ Select and use appropriate hand tools and/or power tools for collecting data about a problem or a design solution ♦ Record observations and/or measurements to produce data to serve as evidence for selecting a material for an intended purpose ♦ Test two different models to create the same product using human control vs. computer control to determine which better meets criteria for success	**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about the materials (e.g., metals, plastics, wood, ceramic) that could be used for a design solution ♦ Evaluate if qualitative or quantitative data is best to collect as evidence when selecting a method for manufacturing (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety) ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) to establish evidence for evaluating the materials that could be used for a design solution ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) to establish evidence for evaluating the use of human control vs. computer control of a process	**6. Constructing explanations (cont.)** ♦ Explain the relationship between the criteria/constraints of a problem and a design solution that requires the evaluation of materials ♦ Explain why a specific tool was selected to accomplish a design task ♦ Draw conclusions based on multiple pieces of evidence (e.g., from prototype testing) about the effectiveness of a material used in a design solution ♦ Draw conclusions based on multiple pieces of evidence (e.g., from prototype testing, simulations, data) about the effectiveness of using computer control in a design solution **7. Engaging in argument from evidence** ♦ Use scientific evidence to support an argument about the solution that best fits a problem's criteria/constraints related to material properties ♦ Use scientific evidence to support an argument about the solution that best fits a problem's criteria/constraints related to manufacturing process ♦ Use scientific evidence to support an argument about the tools used to define a problem or construct solution ♦ Compare and critique two arguments about the solution that best fits a design problem related to human control vs. computer control

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Materials, Tools, and Manufac-turing (cont.)			**7. Engaging in argument from evidence (cont.)** ♦ Defend a claim about the merit of materials used in a design solution by citing relevant evidence (e.g., physical properties, how materials are processed) **8. Obtaining, evaluating, and communicating information** ♦ Research and present information about the criteria/constraints of a design problem or a design solution related to of human control vs. computer control of a process ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas about the materials used in a design solution and their properties ♦ Combine scientific information from multiple sources to explain the basic manufacturing processes (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety) for creating a product ♦ Combine scientific information from multiple sources to explain how processing materials (e.g., cutting, forming, extruding, sanding) may or may not change the property of the material (e.g., strength of material with folding, malleability with heating)

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems	**1. Asking questions/defining problems** ♦ Ask questions about what would happen if a variable was changed in a test of a prototype related to a design problem about structural systems (e.g., student constructed tower, bridge) ♦ Identify scientific (testable) and non-scientific (non-testable) questions about a solution to a design problem about communication systems ♦ Identify scientific (testable) and non-scientific (non-testable) questions about a solution to a design problem about transportation systems ♦ Use prior knowledge to describe design problems that can be solved using communication systems ♦ Use prior knowledge to describe design problems that can be solved using transportation systems ♦ Generate scientific questions about a design problem based on research and/or observations about structural systems (e.g., student constructed tower, bridge) ♦ Determine several criteria for success and constraints on materials, time, or cost, when defining a design problem related to transporting goods or people	**3. Analyzing and interpreting data** ♦ Use observations and/or data to determine the criteria/constraints of a design problem about communication systems (e.g., message must be encrypted, message must travel long distance) ♦ Use observations and/or data (e.g., from prototype testing) to determine the validity of a design solution related to communication systems ♦ Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the successes and failures of a design solution about structural systems (e.g., student constructed tower, bridge) ♦ Analyze and interpret data to make sense of the successes and failures of a design solution related to transportation systems ♦ Analyze and interpret data to determine the most appropriate and efficient mode(s) of transportation given a specific need (e.g., lumber from the lumber mill, commuters traveling home from work) ♦ Compare and contrast the result of a design solution to the criteria/constraints of the design problem related to transportation systems ♦ Use observations and/or data to evaluate and/or refine design solutions related to structural systems (e.g., student constructed tower, bridge)	**5. Developing and using models** ♦ Develop, revise, and/or use a model to show/explain a problem or design solution related to communication systems ♦ Develop, revise, and/or use a model to show/explain a problem or design solution related to transportation systems ♦ Develop, revise, and/or use a model to show/explain a problem or design solution related to structural systems ♦ Develop, revise, and/or use a model to show/explain how a communication system works ♦ Develop, revise, and/or use a model to show/explain the components of a transportation system ♦ Develop, revise, and/or use a model to show/explain the forces (e.g., tension, torsion, compression, shear) on a structural system ♦ Develop, revise, and/or use a model to show/explain the inputs, processes, and outputs of a technological system **6. Constructing explanations** ♦ Explain the criteria/constraints of a problem related to transportation systems ♦ Explain the elements of a design solution related to communication systems (e.g., mode of communication for a particular purpose)

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or conduct a test of a design solution of a structural system (e.g., student constructed tower, bridge) to produce data to serve as evidence ♦ Select and use appropriate methods and/or tools for collecting data about a problem or a design solution related to a communication system ♦ Record observations and/or measurements to produce data to serve as evidence for a problem or a design solution about a transportation system ♦ Record observations and/or measurements to produce data to serve as evidence for a problem or a design solution related to optimizing the transport of goods or people ♦ Test two different models of the same proposed design solution related to communication systems to determine which better meets criteria for success	**4. Using mathematics and computational thinking** ♦ Organize simple data sets to reveal patterns about a problem or a design solution related to structural systems (e.g., student constructed tower, bridge) ♦ Organize simple data sets to reveal patterns about the inputs and outputs of technological systems (e.g., commuters entering the transportation system [input], route of transportation system [processes], commuters exiting the transportation system [output]) ♦ Evaluate if qualitative or quantitative data is best to collect as evidence when defining a problem or testing a design solution related to communication systems (e.g., clarity, speed of encoding/decoding) ♦ Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) to establish evidence defining a problem or evaluating a design solution related to structural systems (e.g., live loads, dead loads) ♦ Use scale and proportion in diagrams (e.g., scale drawings) representing design solutions related to structural systems (e.g., student constructed tower, bridge)	**6. Constructing explanations (cont.)** ♦ Explain the relationship between the criteria/constraints of a problem and a design solution related to transportation systems ♦ Explain how the inputs are influenced by the processes of a technological system to generate outputs ♦ Draw conclusions based on multiple pieces of evidence (e.g., from prototype testing) about the effectiveness of a design solution related to structural systems ♦ Generate and compare multiple solutions to a problem related to communication systems (e.g., mode of communication for a particular purpose) ♦ Use observations and data from investigations to design a solution to a problem related to structural systems **7. Engaging in argument from evidence** ♦ Use scientific evidence to support an argument about how the inputs are influenced by the processes of a technological system to generate outputs ♦ Use scientific evidence to support an argument about the optimal mode of communication for a particular purpose ♦ Use scientific evidence to support an argument about the optimal mode of transportation for goods or people

ENTRY POINTS to Technology/Engineering Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Techno-logical Systems (cont.)			**7. Engaging in argument from evidence (cont.)** ♦ Compare and critique two arguments about the solution that best fits a problem's criteria/constraints related to transportation systems ♦ Defend a claim about the merit of a design solution about structural systems by citing relevant evidence (e.g. evidence from prototype testing) **8. Obtaining, evaluating, and communicating information** ♦ Research and present information about the criteria/constraints of a design problem or a design solution related to a structural system ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas about the criteria/constraints of a design problem or a design solution related to the mode of communication for a particular purpose ♦ Combine scientific information from multiple sources to explain the criteria/constraints of a design problem or a design solution related to the optimal mode of transportation for goods or people ♦ Combine scientific information from multiple sources to explain that technological systems have inputs, processes, feedback, and outputs

Science and Technology/Engineering
High School

Biology

Core Idea	Access Skills	High School
From Molecules to Organisms: Structures and Processes	Pages 51–53	Pages 181–182, 186–189
Ecosystems: Interactions, Energy, and Dynamics	Pages 53–55	Pages 182–184, 189–192
Heredity: Inheritance and Variation of Traits	Pages 56–58	Pages 184–185, 193–195
Biological Evolution: Unity and Diversity	Pages 58–60	Pages 185, 195–198

Grade Level: High School

Core Idea		Learning Standards as written
From Molecules to Organisms: Structures and Processes	**HS-LS1-1**	Construct a model of transcription and translation to explain the roles of DNA and RNA that code for proteins that regulate and carry out essential functions of life. Clarification Statements: ♦ Proteins that regulate and carry out essential functions of life include enzymes (which speed up chemical reactions), structural proteins (which provide structure and enable movement), and hormones and receptors (which send and receive signals). ♦ The model should show the double-stranded structure of DNA, including genes as part of DNA's transcribed strand, with complementary bases on the nontranscribed strand.
	HS-LS1-2	Develop and use a model to illustrate the key functions of animal body systems, including (a) food digestion, nutrient uptake, and transport through the body; (b)exchange of oxygen and carbon dioxide; (c) removal of wastes; and (d) regulation of body processes. Clarification Statement: ♦ Emphasis is on the primary function of the following body systems (and structures): digestive (mouth, stomach, small intestine [villi], large intestine, pancreas), respiratory (lungs [alveoli], diaphragm), circulatory (heart, veins, arteries, capillaries), excretory (kidneys, liver, skin), and nervous (neurons, brain, spinal cord).
	HS-LS1-3	Provide evidence that homeostasis maintains internal body conditions through both body-wide feedback mechanisms and small-scale cellular processes. Clarification Statements: ♦ Feedback mechanisms include the promotion of a stimulus through positive feedback (e.g., injured tissues releasing chemicals in blood that activate platelets to facilitate blood clotting), and the inhibition of stimulus through negative feedback (e.g., insulin reducing high blood glucose to normal levels). ♦ Cellular processes include (a) passive transport and active transport of materials across the cell membrane to maintain specific concentrations of water and other nutrients in the cell and (b) the role of lysosomes in recycling wastes, macromolecules, and cell parts into monomers.
	HS-LS1-4	Construct an explanation using evidence for why the cell cycle is necessary for the growth, maintenance, and repair of multicellular organisms. Model the major events of the cell cycle, including (a) cell growth and DNA replication, (b) separation of chromosomes (mitosis), and (c) separation of cell contents.

Grade Level: High School

Core Idea	Learning Standards as written	
From Molecules to Organisms: Structures and Processes (cont.)	**HS-LS1-5**	Use a model to illustrate how photosynthesis uses light energy to transform water and carbon dioxide into oxygen and chemical energy stored in the bonds of sugars and other carbohydrates. Clarification Statements: ♦ Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. ♦ Examples of models could include diagrams, chemical equations, and conceptual models
	HS-LS1-6	Construct an explanation based on evidence that organic molecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form monomers that can further combine to form large carbon-based macromolecules. Clarification Statements: ♦ Monomers include amino acids, mono- and disaccharides, nucleotides, and fatty acids. ♦ Organic macromolecules include proteins, carbohydrates (polysaccharides), nucleic acids, and lipids.
	HS-LS1-7	Use a model to illustrate that aerobic cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new bonds form, resulting in new compounds and a net transfer of energy. Clarification Statements: ♦ Emphasis is on the conceptual understanding of the inputs and outputs of the process of aerobic cellular respiration. ♦ Examples of models could include diagrams, chemical equations, and conceptual models. ♦ The model should include the role of ATP for energy transfer in this process. ♦ Food molecules include sugars (carbohydrates), fats (lipids), and proteins.
Ecosystem: Interaction, Energy, and Dynamics	**HS-LS2-1**	Analyze data sets to support explanations that biotic and abiotic factors affect ecosystem carrying capacity. Clarification Statements: ♦ Examples of biotic factors could include relationships among individuals (e.g., feeding relationships, symbioses, competition) and disease. ♦ Examples of abiotic factors could include climate and weather conditions, natural disasters, and availability of resources. ♦ Example data sets can be derived from simulations or historical data.

Grade Level: High School

Core Idea	Learning Standards as written	
Ecosystem: Interaction, Energy, and Dynamics (cont.)	**HS-LS2-2**	Use mathematical representations to support explanations that biotic and abiotic factors affect biodiversity, including genetic diversity within a population and species diversity within an ecosystem. Clarification Statements: ♦ Examples of biotic factors could include relationships among individuals (feeding relationships, symbiosis, competition) and disease. ♦ Examples of abiotic factors could include climate and weather conditions, natural disasters, and availability of resources. ♦ Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.
	HS-LS2-4	Use a mathematical model to describe the transfer of energy from one trophic level to another. Explain how the inefficiency of energy transfer between trophic levels affects the relative number of organisms that can be supported at each trophic level and necessitates a constant input of energy from sunlight or inorganic compounds from the environment. Clarification Statement: ♦ The model should illustrate the "10% rule" of energy transfer and show approximate amounts of available energy at each trophic level in an ecosystem (up to five trophic levels).
	HS-LS2-5	Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere. Clarification Statements: ♦ The primary forms of carbon include carbon dioxide, hydrocarbons, waste (dead organic matter), and biomass (organic materials of living organisms). ♦ Examples of models could include simulations and mathematical models.
	HS-LS2-6	Analyze data to show ecosystems tend to maintain relatively consistent numbers and types of organisms even when small changes in conditions occur but that extreme fluctuations in conditions may result in a new ecosystem. Construct an argument supported by evidence that ecosystems with greater biodiversity tend to have greater resistance to change and resilience. Clarification Statement: ♦ Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption, fires, the decline or loss of a keystone species, climate changes, ocean acidification, or sea level rise.

Grade Level: High School

Core Idea	Learning Standards as written	
Ecosystem: Interaction, Energy, and Dynamics (cont.)	**HS-LS2-7**	Analyze direct and indirect effects of human activities on biodiversity and ecosystem health, specifically habitat fragmentation, introduction of non-native or invasive species, overharvesting, pollution, and climate change. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health. Clarification Statement: ♦ Examples of solutions can include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, and ecotourism.
	[HS-LS2-3 has been merged with HS-LS2-4 and HS-LS2-5. HS-LS2-8 from NGSS is not included.]	
Heredity: Inheritance and Variation of Traits	**HS-LS3-1**	Develop and use a model to show how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction. Clarification Statement: ♦ The model should demonstrate that an individual's characteristics (phenotype) result, in part, from interactions among the various proteins expressed by one's genes (genotype).
	HS-LS3-2	Make and defend a claim based on evidence that genetic variations (alleles) may result from (a) new genetic combinations via the processes of crossing over and random segregation of chromosomes during meiosis, (b) mutations that occur during replication, and/or (c) mutations caused by environmental factors. Recognize that mutations that occur in gametes can be passed to offspring. Clarification Statement: ♦ Examples of evidence of genetic variation can include the work of McClintock in crossing over of maize chromosomes and the development of cancer due to DNA replication errors and UV ray exposure.
	HS-LS3-3	Apply concepts of probability to represent possible genotype and phenotype combinations in offspring caused by different types of Mendelian inheritance patterns. Clarification Statements: ♦ Representations can include Punnett squares, diagrams, pedigree charts, and simulations. ♦ Inheritance patterns include dominant-recessive, codominance, incomplete dominance, and sex-linked.

Grade Level: High School

Core Idea	Learning Standards as written	
Heredity: Inheritance and Variation of Traits (cont.)	**HS-LS3-4(MA)**	Use scientific information to illustrate that many traits of individuals, and the presence of specific alleles in a population, are due to interactions of genetic factors and environmental factors. Clarification Statements: ♦ Examples of genetic factors include the presence of multiple alleles for one gene and multiple genes influencing a trait. ♦ An example of the role of the environment in expressed traits in an individual can include the likelihood of developing inherited diseases (e.g., heart disease, cancer) in relation to exposure to environmental toxins and lifestyle; an example in populations can include the maintenance of the allele for sickle-cell anemia in high frequency in malaria-affected regions because it confers partial resistance to malaria.
Biological Evolution: Unity and Diversity	**HS-LS4-1**	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence, including molecular, anatomical, and developmental similarities inherited from a common ancestor (homologies), seen through fossils and laboratory and field observations. Clarification Statement: ♦ Examples of evidence can include the work of Margulis on endosymbiosis, examination of genomes, and analyses of vestigial or skeletal structures.
	HS-LS4-2	Construct an explanation based on evidence that Darwin's theory of evolution by natural selection occurs in a population when the following conditions are met: (a) more offspring are produced than can be supported by the environment, (b) there is heritable variation among individuals, and (c) some of these variations lead to differential fitness among individuals as some individuals are better able to compete for limited resources than others. Clarification Statement: ♦ Emphasis is on the overall result of an increase in the proportion of those individuals with advantageous heritable traits that are better able to survive and reproduce in the environment.
	HS-LS4-4	Research and communicate information about key features of viruses and bacteria to explain their ability to adapt and reproduce in a wide variety of environments. Clarification Statement: ♦ Key features include high rate of mutations and the speed of reproduction which produces many generations with high variability in a short time, allowing for rapid adaptation.
	HS-LS4-5	Evaluate models that demonstrate how changes in an environment may result in the evolution of a population of a given species, the emergence of new species over generations, or the extinction of other species due to the processes of genetic drift, gene flow, mutation, and natural selection.
	[HS-LS4-3 from NGSS is merged with HS-LS4-2. HS-LS4-6 from NGSS is not included.]	

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes	**1. Asking questions/defining problems** ♦ Generate a scientific question that is testable about enzyme catalysis using available resources in a school setting ♦ Generate a scientific question that is testable based on observations, models, and/or results from an investigation about how body systems work together (e.g., digestive, respiratory, circulatory, excretory, and nervous systems) ♦ Generate a scientific question that is testable about how the function of an organ/system could be affected by disease or environmental variables (e.g., temperature, pH, oxygen) ♦ Generate a scientific question about environmental variables that could affect photosynthesis (e.g., light intensity, temperature, CO2 levels) ♦ Generate a testable scientific question about which substances are capable of crossing a semi-permeable membrane **2. Planning and carrying out investigations** ♦ Select appropriate tools to conduct an investigation of cellular respiration in living organisms (e.g., germinating peas or breeding insects) and describe the variables that will be measured to determine the rate of cellular respiration	**3. Analyzing and interpreting data** ♦ Analyze data from a table or graph to determine which solution best matches the solute concentration of the living cells (e.g., potato cores) ♦ Create a graph (e.g., line, bar, circle) to compare the rate of photosynthesis under different experimental conditions (Rate of photosynthesis can be measured either as the uptake of CO2, the production of O2, or the increase in biomass) ♦ Analyze data from a table or graph to determine the impact of environmental variables (e.g., light intensity or carbon dioxide concentration) on photosynthesis ♦ Analyze data from a table or graph to show how the function of organ/system is affected by a disease or environmental variables ♦ Create an appropriate visual representation of data (e.g., line graph, bar graph, circle graph, table) to show the rates of cellular respiration under different conditions	**5. Developing and using models** ♦ Construct a model of organic macromolecules (carbohydrates, lipids, proteins, and nucleic acids) to show their molecular building blocks (monosaccharides, fatty acids, amino acids, nucleic acids). ♦ Construct a model to show the double-stranded nature of DNA and complementary base pairs. ♦ Use a model of negative feedback loops to show homeostasis (e.g., regulation of blood glucose or body temperature) ♦ Use a codon table to translate an mRNA sequence into an amino acid sequence ♦ Use a codon table to compare DNA mutations to determine if the mutation would affect the protein structure ♦ Construct a model of the basic structure of a cell membrane to show how substances (e.g., oxygen, glucose, amino acids) move into and out of a cell ♦ Use a model to describe the reactants and products of photosynthesis ♦ Construct a model of a plant cell to show that photosynthesis takes place in chloroplasts

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)	**2. Planning and carrying out investigations (cont.)** ♦ Plan and/or follow the steps of an investigation to examine the effect of light intensity or temperature on the rate of photosynthesis (e.g., floating leaf discs) ♦ Plan and/or follow the steps of an investigation to examine the movement of substances across a semi-permeable membrane (e.g., dialysis tubing or living plant cells) ♦ Plan and/or follow the steps of an investigation to examine mitosis in living cells (e.g., root tip lab)	**4. Using mathematics and computational thinking** ♦ Use mathematical concepts to calculate the change in mass of living cells (e.g., potato cores) exposed to different types of solutions. ♦ Apply mathematical concepts and/or processes (basic operations) to calculate the rate of a chemical reaction (e.g., photosynthesis, cellular respiration, or enzyme catalysis)	**6. Constructing explanations** ♦ Construct an explanation of why living cells placed in a solution with a higher solute concentration lose mass based on the results of an investigation. ♦ Construct an explanation of how your body maintains a healthy level of blood glucose based on models of feedback loops and written descriptions ♦ Construct an explanation comparing the products of transcription and translation. ♦ Construct an explanation of what happens during the major events of the cell cycle (growth, replication, mitosis, cytokinesis) based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation of how the structure of organs in human body systems contributes to their function (e.g., alveoli in lungs, capillaries in villi, sensory vs. motor neurons, etc.) ♦ Construct an explanation of how the structure of the cell membrane (phospholipids and member proteins) based on a variety of sources (e.g., model, research, investigation, simulation) allows the cell membrane to be permeable ♦ Use scientific evidence to explain the importance of concentration gradients in passive transport ♦ Use scientific evidence about homeostasis to explain how your body regulates blood glucose

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)			**7. Engaging in argument from evidence** ♦ Make and defend a claim based on scientific evidence that mutations in a cell's DNA can result in proteins that do not function properly. ♦ Use scientific evidence to construct an argument about how the double-helix structure of DNA protects the genetic code and allows for transcription of genetic information ♦ Use scientific evidence and observations to construct an argument about how the function of organs or body/systems could be affected by disease or environmental variables **8. Obtaining, evaluating, and communicating information** ♦ Research, record, and present information showing how body systems work together to deliver oxygen and nutrients to cells and remove waste products from cells ♦ Communicate scientific information (orally, graphically, textually, and/or mathematically) about the differences between the products of mitosis and meiosis ♦ Research, record, and present information showing the transcription of DNA to mRNA ♦ Communicate (orally, graphically, textually, and/or mathematically) (scientific information about the importance of the cell cycle in replacing damaged cells

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information about how body systems (digestive, respiratory, circulatory, excretory, nervous) work together to maintain life functions ♦ Research, record, and present information showing the basic functions and importance of enzymes and membrane proteins ♦ Research, record, and present information to compare active and passive cell transport ♦ Communicate information about the primary functions of the four organic macromolecules (e.g., carbohydrates, lipids, proteins, and nucleic acids)
Ecosystems: Interactions, Energy, and Dynamics	**1. Asking questions/defining problems** ♦ Determine criteria for and constraints on (e.g. cost, safety, reliability, aesthetics,) mitigating the impact of humans on ecosystems (e.g., captive breeding programs, habitat restoration, pollution mitigation, energy conservation, ecotourism) ♦ Generate a scientific question that is testable based on observations, models, and/or results of an investigation of human impacts on the health of an ecosystem	**3. Analyzing and interpreting data** ♦ Analyze data from a graph to describe the difference between exponential growth and logistic growth ♦ Analyze data from a graph of population size to show fluctuations in an ecosystem's carrying capacity as a result of limited resources ♦ Analyze data from a graph that shows atmospheric CO2 data from an active volcano (e.g., Mauna Loa) to describe seasonal fluctuations and data trends over time	**5. Developing and using models** ♦ Evaluate a food web model and other scientific information to describe the relationships among individuals in a food web (e.g., feeding relationships, symbioses, or competition) ♦ Use a food web model to describe how changes in one population can affect another population (e.g., how is prey population affected if a predator population increases?) ♦ Use a food web model or energy pyramid to describe how energy flows through an ecosystem

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Generate a scientific question that is testable based on observations, models, and/or results from an investigation of an ecosystem's ability to respond to moderate environmental changes (ecosystem resilience) ♦ Evaluate a scientific question to determine if the question is relevant to a specific change in a population of an ecosystem **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data from a predator-prey simulation ♦ Plan and/or follow the steps of an investigation to collect data on carbon cycling using living organisms (e.g., plants or insects) in a closed system ♦ Plan and/or follow the steps of an investigation to collect data on the biodiversity of a local ecosystem (e.g., quadrant sampling of a tidepool or forest)	**3. Analyzing and interpreting data (cont.)** ♦ Create a graph (e.g., line, bar, circle) to show fluctuations in oxygen and carbon dioxide based on an investigation of living organisms in a closed system ♦ Create appropriate visual representation of data (e.g., line graph, bar graph, circle graph, table) to show how invasive species impact ecosystems over time **4. Using mathematics and computational thinking** ♦ Use the population growth equation to calculate the growth rate of a population ♦ Apply mathematical concepts and/or processes (ratios, rates, percentages, proportions, and/or basic operations) to determine how much energy is available at each trophic level (10% rule)	**5. Developing and using models (cont.)** ♦ Construct an energy pyramid model of an ecosystem to illustrate the role of organisms from different trophic levels (e.g., producers, consumers, decomposers) ♦ Use a model to describe how carbon cycles in various forms between living organisms and the environment ♦ Use a model of an ecosystem to describe the abiotic and biotic factors in the ecosystem **6. Constructing explanations** ♦ Construct an explanation of how changes to an ecosystem affect carrying capacity based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation of why an ecosystem remains relatively consistent, even with moderate change (e.g., hunting or a seasonal flood) using a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation of how an extreme environmental change in an ecosystem (e.g., volcanic eruption, fires, decline or loss of a keystone species, climate changes, ocean acidification, or sea level rise) may result in a new ecosystem using a variety of sources (e.g., model, research, investigation, simulation)

ENTRY POINTS to
Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)			**6. Constructing explanations (cont.)** ♦ Construct an explanation based on a variety of sources (e.g., model, research, investigation, simulation) describing why only 10% of the energy passes from one trophic level to the next ♦ Construct an explanation to describe the role of producers, consumers, and decomposers in an ecosystem, based on a variety of sources (e.g., model, research, investigation, simulation) **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about how humans can reduce their impact on natural systems ♦ Make and defend a claim based on scientific evidence that ecosystems with greater biodiversity tend to have greater resilience and resistance to change ♦ Make and defend a claim that human activity (e.g., habitat fragmentation, invasive species, overharvesting, pollution, and climate change) impacts the health of an ecosystem based on a variety of sources (e.g., model, research, investigation, simulation) **8. Obtaining, evaluating, and communicating information** ♦ Research, record, and present information showing how abiotic and biotic factors influence the carrying capacity of a population

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research, record, and/or present information describing examples of symbiotic relationships (e.g., parasitism, commensalism, and mutualism) within an ecosystem ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information about what characteristics allow invasive species to have a disproportionate impact on the environment ♦ Communicate scientific information (orally, graphically, textually, or mathematically) about different design solutions to reduce human impacts on ecosystems (e.g., captive breeding programs, habitat restoration, pollution mitigation, energy conservation, and ecotourism). The design solutions should meet criteria and constraints such as cost, safety, reliability, and aesthetics ♦ Research, record, and present information about how the primary forms of carbon (e.g., carbon dioxide, hydrocarbons, waste/dead organic matter, and biomass) cycle through ecosystems ♦ Research, record, and present information about the effects of human activity on ecosystem health (e.g., habitat fragmentation, invasive species, overharvesting, pollution, climate change)

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits	**1. Asking questions/defining problems** ♦ Generate a scientific question that is testable about heritable traits based on observations, models (e.g., Punnett squares, pedigrees) and/or results from an investigation ♦ Evaluate a scientific question to determine if it is testable and/or relevant to mutations or genetic variation ♦ Generate a scientific question that is testable about how traits are passed to offspring based on observations, models, and/or results from an investigation ♦ Generate a scientific question about inheritance patterns based on observations and/or data (e.g., dominant/recessive, co-dominance, incomplete dominance, sex linked) **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data about the allele frequencies in a sample of students (e.g., attached vs. detached ear lobes, blood types, tasters, etc.). ♦ Plan and/or follow the steps of an investigation to conduct a test cross to collect data that will determine if a dominant phenotype is the result of a homozygous (AA) or heterozygous (Aa) genotype ♦ Plan and/or follow the steps of an investigation to collect data on the inheritance patterns of dominant/ recessive alleles (e.g., dragon genetics)	**3. Analyzing and interpreting data** ♦ Analyze data from a table or graph (e.g. pedigree chart) to determine the inheritance pattern for a specific trait ♦ Analyze data from a heritability table to determine the likelihood that a trait will be influenced by the environment versus heredity ♦ Analyze data from a table or graph to determine the allele frequencies of a certain trait in two different populations ♦ Analyze data from a Punnett square or pedigree to determine the inheritance patterns of a particular trait **4. Using mathematics and computational thinking** ♦ Apply mathematical concepts and/or processes (ratios, percentages, proportions, and/or basic operations) to determine the probability of certain phenotypes in a monohybrid or dihybrid cross ♦ Apply mathematical concepts and/or processes (ratios, percentages, proportions, and/or basic operations) to determine the probability of certain genotypes in a monohybrid or dihybrid cross	**5. Developing and using models** ♦ Use a model to describe the events in meiosis that result in genetically unique haploid gametes ♦ Construct a model showing how gametes combine during fertilization to produce a diploid organism ♦ Construct a model of homologous chromosomes that demonstrates genetic recombination (crossing over) ♦ Construct a pedigree chart to demonstrate how a sex-linked trait is passed across multiple generations **6. Constructing explanations** ♦ Construct an explanation of how sexual reproduction produces genetic diversity (e.g., crossing over and independent assortment during meiosis and random pairing of gametes during fertilization) based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation of why the reduction of chromosome number during meiosis is necessary for an organism to maintain its diploid chromosome number based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation of how genetic mutations are passed from parents to offspring based on a variety of sources (e.g., model, research, investigation, simulation)

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)			**6. Constructing explanations (cont.)** ♦ Construct an explanation of why not all DNA mutations create changes in the sequence of amino acids of a protein based on a variety of sources (e.g., model, research, investigation, simulation) **7. Engaging in argument from evidence** ♦ Use scientific evidence to construct an argument about the relationship between an organism's genotype and its observable characteristics (phenotype) ♦ Use observations of physical characteristics to construct an argument that a trait is affected by multiple genes (polygenic) or a single gene with two alleles ♦ Use the inheritance of human sex chromosomes (XX or XY) to argue that it is the father's gamete and not the mother's gamete that determines the sex genotype of their offspring ♦ Use scientific evidence and observations to construct an argument about the inheritance pattern of a particular trait **8. Obtaining, evaluating, and communicating information** ♦ Research, record, and present information showing how the genetic information in chromosomes is passed from parents to offspring

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Heredity: Inheritance and Variation of Traits (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research, record, and present information showing the results of a pedigree chart explaining the probability of a child inheriting a genetic trait (e.g., Huntington's disease, cystic fibrosis, sickle cell anemia) ♦ Communicate (orally, graphically, textually, and/or mathematically) scientific information about how an inherited mutation can become a source of new traits within a population
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ♦ Evaluate a scientific question about observable traits of an organism to determine if it is testable or relevant to natural selection ♦ Generate a scientific question that is testable about the relatedness between species based on the comparison of DNA sequences (e.g., BLAST lab) ♦ Generate scientific question about why bacteria develop resistance to antibiotics ♦ Generate scientific questions based on observations or data about the evolution of a species	**3. Analyzing and interpreting data** ♦ Analyze data from a table to compare DNA or amino acid sequences to assess the degree of relatedness between different species ♦ Analyze data (e.g., from a classroom game or simulation) of the difference in survival rates of organisms with certain physical traits (e.g., natural selection simulation, evolution in action) ♦ Analyze data from a table or graph to determine how genetic variety in a population influences the long-term survival of a population **4. Using mathematics and computational thinking** ♦ Apply mathematical concepts (e.g., ratios, percentages, proportions) to changes in traits over time in a population undergoing evolution	**5. Developing and using models** ♦ Construct a model of an evolutionary tree using an online model building tool (e.g., Nova Evolution Lab) ♦ Use a model (e.g., cladogram or evolutionary tree) to describe the evolutionary relationships between species ♦ Construct a model of homologous bone structures in upper and lower limbs that demonstrates common ancestry among mammals ♦ Use a model of natural selection to explain how a structure or trait that provides a survival or reproductive advantage will become more common in a population (e.g., bacteria) over time

ENTRY POINTS to Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation (e.g., computer simulation) to examine the role of environmental variables (e.g., changes in resources, competitors, predators, disease, and/or climate) on the evolution of a species ♦ Select and/or create the appropriate table or organizer to collect data from an investigation ♦ of natural selection (e.g., natural selection game) ♦ Plan and/or follow the steps of an investigation to simulate antibiotic resistance in bacteria		**6. Constructing explanations** ♦ Construct an explanation to show that large changes in allele frequencies in a population can result from small evolutionary adaptations over time (e.g., a slightly higher birth rate) ♦ Construct an explanation of how homologous structures provide evidence of common ancestry (e.g., similarities in the structure of limb bones) based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation that genetic variation within a species is important to the long-term survival of that species based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation of how changing selection pressures, such as competition for limited resources, predation, climate change, or disease, can favor certain adaptations based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation based on a variety of sources (e.g., model, research, investigation, simulation) of why speciation is unlikely to occur unless gene flow between populations is excluded by geographic or reproductive isolation ♦ Use scientific evidence to explain the difference between natural selection and evolution

ENTRY POINTS to
Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**7. Engaging in argument from evidence** ♦ Make and defend a claim about evolution based on the fossil record (e.g., whales were descended from land mammals, homologous structures). ♦ Use scientific evidence to construct an argument that environmental selection pressures allow some species to have similar structures or characteristics even though they are not closely related (i.e., convergent evolution). ♦ Make and defend a claim about why bacteria and viruses are so highly adaptive to environmental change (e.g., simple structures, high mutation rates, short generation times) ♦ Use scientific evidence to construct an argument that most species will become extinct ♦ Make and defend a claim about natural selection using Darwin's observations of structural differences in the beaks of finches **8. Obtaining, evaluating, and communicating information** ♦ Research, record, and present Hardy Weinberg's conditions for stability that lead to the evolution of a species by natural selection (i.e., variation in inherited traits, selection pressures that favor certain adaptive characteristics, and differential survival and reproduction)

ENTRY POINTS to
Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Research, record, and present information about how extreme changes in environmental conditions can cause mass extinction events (e.g., Permian, K-T event) ♦ Research, record, and present information comparing the reproduction of bacteria versus viruses ♦ Research, record, and present information showing how changes in environment can result in the evolution of a population due to the processes of genetic drift, gene flow, mutation, or natural selection

Science and Technology/Engineering
High School

Introductory Physics

Core Idea	Access Skills	High School
Matter and Its Interactions	Pages 107–109	Pages 200, 204
Motion and Stability: Forces and Interactions	Pages 110–111	Pages 200–201, 204–206
Energy	Pages 112–114	Pages 201–202, 206–208
Waves and Their Applications in Technologies for Information Transfer	Pages 114–116	Pages 203, 208–210

CONTENT Science and Technology/Engineering
DISCIPLINE Introductory Physics

Grade Level: High School

Core Idea	Learning Standards as written	
Matter and Its Interactions	**HS-PS1-8**	Develop a model to illustrate the energy released or absorbed during the processes of fission, fusion, and radioactive decay. Clarification Statements: ♦ Examples of models include simple qualitative models, such as pictures or diagrams. ♦ Types of radioactive decay include alpha, beta, and gamma.
Motion and Stability: Forces and Interactions	**HS-PS2-1**	Analyze data to support the claim that Newton's second law of motion is a mathematical model describing change in motion (the acceleration) of objects when acted on by a net force. Clarification Statements: ♦ Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, and a moving object being pulled by a constant force. ♦ Forces can include contact forces, including friction, and forces acting at a distance, such as gravity and magnetic forces.
	HS-PS2-2	Use mathematical representations to show that the total momentum of a system of interacting objects is conserved when there is no net force on the system. Clarification Statement: ♦ Emphasis is on the qualitative meaning of the conservation of momentum and the quantitative understanding of the conservation of linear momentum in interactions involving elastic and inelastic collisions between two objects in one dimension.
	HS-PS2-3	Apply scientific principles of motion and momentum to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. Clarification Statement: ♦ Both qualitative evaluations and algebraic manipulations may be used.
	HS-PS2-4	Use mathematical representations of Newton's law of gravitation and Coulomb's law to both qualitatively and quantitatively describe and predict the effects of gravitational and electrostatic forces between objects. Clarification Statement: ♦ Emphasis is on the relative changes when distance, mass or charge, or both are changed.

Grade Level: High School

Core Idea	Learning Standards as written	
Motion and Stability: Forces and Interactions (cont.)	**HS-PS2-5**	Provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. Clarification Statement: ♦ Examples of evidence can include movement of a magnetic compass when placed in the vicinity of a current-carrying wire, and a magnet passing through a coil that turns on the light of a Faraday flashlight.
	HS-PS2-9(MA)	Evaluate simple series and parallel circuits to predict changes to voltage, current, or resistance when simple changes are made to a circuit. Clarification Statements: ♦ Predictions of changes can be represented numerically, graphically, or algebraically using Ohm's law. ♦ Simple changes to a circuit may include adding a component, changing the resistance of a load, and adding a parallel path, in circuits with batteries and common loads. ♦ Simple circuits can be represented in schematic diagrams.
	HS-PS2-10(MA)	Use free-body force diagrams, algebraic expressions, and Newton's laws of motion to predict changes to velocity and acceleration for an object moving in one dimension in various situations. Clarification Statements: ♦ Predictions of changes in motion can be made numerically, graphically, and algebraically using basic equations for velocity, constant acceleration, and Newton's first and second laws. ♦ Forces can include contact forces, including friction, and forces acting at a distance, such as gravity and magnetic forces.
	[HS-PS2-6, HS-PS2-7(MA), and HS-PS2-8(MA) are found in chemistry.]	
Energy	**HS-PS3-1**	Use algebraic expressions and the principle of energy conservation to calculate the change in energy of one component of a system when the change in energy of the other component(s) of the system, as well as the total energy of the system including any energy entering or leaving the system, is known. Identify any transformations from one form of energy to another, including thermal, kinetic, gravitational, magnetic, or electrical energy, in the system. Clarification Statement: ♦ Systems should be limited to two or three components and to thermal energy; kinetic energy; or the energies in gravitational, magnetic, or electric fields.

Grade Level: High School

Core Idea	Learning Standards as written	
Energy (cont.)	**HS-PS3-2**	Develop and use a model to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles and objects or energy stored in fields. Clarification Statements: ♦ Examples of phenomena at the macroscopic scale could include evaporation and condensation, the conversion of kinetic energy to thermal energy, the gravitational potential energy stored due to position of an object above the earth, and the stored energy (electrical potential) of a charged object's position within an electrical field. ♦ Examples of models could include diagrams, drawings, descriptions, and computer simulations.
	HS-PS3-3	Design and evaluate a device that works within given constraints to convert one form of energy into another form of energy. Clarification Statements: ♦ Emphasis is on both qualitative and quantitative evaluations of devices. ♦ Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. ♦ Examples of constraints could include use of renewable energy forms and efficiency.
	HS-PS3-4a	Provide evidence that when two objects of different temperature are in thermal contact within a closed system, the transfer of thermal energy from higher-temperature objects to lower-temperature objects results in thermal equilibrium, or a more uniform energy distribution among the objects and that temperature changes necessary to achieve thermal equilibrium depend on the specific heat values of the two substances. Clarification Statement: ♦ Energy changes should be described both quantitatively in a single phase ($Q = mc\Delta T$) and conceptually either in a single phase or during a phase change.
	HS-PS3-5	Develop and use a model of magnetic or electric fields to illustrate the forces and changes in energy between two magnetically or electrically charged objects changing relative position in a magnetic or electric field, respectively. Clarification Statements: ♦ Emphasis is on the change in force and energy as objects move relative to each other. ♦ Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.
	[HS-PS3-4b is found in chemistry.]	

Grade Level: High School

Core Idea	Learning Standards as written	
Waves and Their Applications in Technologies for Information Transfer	**HS-PS4-1**	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling within various media. Recognize that electromagnetic waves can travel through empty space (without a medium) as compared to mechanical waves that require a medium. Clarification Statements: ♦ Emphasis is on relationships when waves travel within a medium, and comparisons when a wave travels in different media. ♦ Examples of situations to consider could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth. ♦ Relationships include $v = \lambda f$, $T = 1/f$, and the qualitative comparison of the speed of a transverse (including electromagnetic) or longitudinal mechanical wave in a solid, liquid, gas, or vacuum.
	HS-PS3-3	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described by either a wave model or a particle model, and that for some situations involving resonance, interference, diffraction, refraction, or the photoelectric effect, one model is more useful than the other. Clarification Statement: ♦ Emphasis is on qualitative reasoning and comparisons of the two models.
	HS-PS3-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. Clarification Statements: ♦ Emphasis is on qualitative information and descriptions. ♦ Examples of technological devices could include solar cells capturing light and converting it to electricity, medical imaging, and communications technology. ♦ Examples of principles of wave behavior include resonance, photoelectric effect, and constructive and destructive interference.
	[HS-PS4-2 and HS-PS4-4 from NGSS are not included.]	

ENTRY POINTS to
Introductory Physics Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions	[Standards for this core idea at High School level are aligned with Chemistry. See entry points for earlier grades in this core idea.]		
Motion and Stability: Forces and Interactions	**1. Asking questions/defining problems** ♦ Generate a scientific question that is testable about the motion of an object, based on observations, models, and/or results from an investigation ♦ Generate a scientific question that is testable about how the mass of an object affects its rate of acceleration when the same net force is acting on it, based on observations, models, and/or results from an investigation of the object ♦ Determine criteria and constraints to define a design problem about minimizing the force of an impact in a collision ♦ Evaluate a scientific question to determine if it is testable and/or relevant to momentum conservation in a collision ♦ Generate a scientific question that is testable about the forces between two charged objects, based on observations, models, and/or results from an investigation ♦ Generate a scientific question that is testable about how a magnetic field can be produced by an electric current, based on observations, models, and/or results from an investigation ♦ Determine criteria and constraints of a design problem that involves electrical or magnetic fields	**3. Analyzing and interpreting data** ♦ Analyze data from a table or graph of mass and net force to determine the conditions under which an object has the greatest acceleration ♦ Create an appropriate visual representation of data (e.g., line graph) to show the position, speed, velocity, and/or acceleration of an object ♦ Analyze data from a position vs. time graph to determine the position and velocity of an object during a time interval in which the object has a constant velocity ♦ Analyze data from a velocity vs. time graph to determine the velocity and acceleration of an object during a time interval in which the object has a constant acceleration ♦ Analyze data from a table or graph, including the velocity of two objects with the same mass before and after a collision, to determine if momentum was conserved ♦ Analyze data from a table or graph to compare the current through resistors that are in series and/or the current through resistors that are in parallel ♦ Analyze data from a table or graph to compare the voltage drop across resistors that are in parallel and/or the voltage drop across resistors that are in series	**5. Developing and using models** ♦ Construct a free-body force diagram (model) of the forces acting on an object ♦ Evaluate free-body force diagrams (models) to determine which object has the greatest or least net force acting on it ♦ Construct a model to explain how momentum is conserved when two objects collide and stick together ♦ Use a model (e.g., computer simulation) of two charged objects to determine how changing the distance between the objects affects the magnitude of the forces between them ♦ Use a model of a gravitational field or an electrical field to identify the direction of the force on a test object in the field (e.g., very small mass, very small charge) ♦ Modify a model of a simple circuit by adding resistors in series and/or in parallel ♦ Construct a circuit diagram (model) using proper schematic symbols **6. Constructing explanations** ♦ Construct an explanation of the relationship between an object with a constant velocity and the forces acting on that object, based on a variety of sources (e.g., model, research, investigation, simulation)

ENTRY POINTS to
Introductory Physics Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to collect data about the position of an object at specific times and/or intervals ♦ Select and/or create the appropriate table or organizer to collect data from an investigation about motion (e.g., including change in position, velocity, acceleration, time) ♦ Plan and/or follow the steps of an investigation to collect data about the motion of objects with different masses or net forces acting upon them ♦ Plan and/or conduct an investigation to measure the velocities of two colliding objects that stick together after impact ♦ Plan and/or follow the steps of an investigation to collect data about the factors that influence the relative strength of a magnetic field produced by a current carrying wire. ♦ Select and use appropriate tools to conduct an investigation about the electric current produced by a changing magnetic field ♦ Plan and/or follow the steps of an investigation to collect data on the voltage drop across resistors in series and in parallel ♦ Select and/or create an appropriate table or organizer to collect data from an investigation about the voltage drop across, current through, and resistance of resistors that are in series or parallel	**4. Using mathematics and computational thinking** ♦ Use the formula $v_f = v_i + a\Delta t$ or $\Delta x = v_i\Delta t + \frac{1}{2}at^2$ to solve problems involving constant acceleration ♦ Use the formula $F_{net} = ma$ to solve for the acceleration, net force, or mass of an object ♦ Use the formula $F_g = mg$ to solve for the mass of an object or force of gravity acting on the object ♦ Apply mathematical concepts and/or processes (proportions, and/or the formula $p = m\Delta v$) to determine the velocity of an object after a collision ♦ Apply mathematical concepts and/or processes (proportions, and/or the formula $F\Delta t = \Delta p$) to determine the change in momentum caused by a force ♦ Use the formula $F_g = G\frac{m_1 m_2}{d^2}$ to solve for the gravitational forces between two objects ♦ Use the formula $V = IR$ (Ohm's law) to solve for the voltage drop across, current through, or resistance of a resistor in a circuit ♦ Apply mathematical concepts and/or processes (e.g., basic operations) to determine the total resistance of multiple resistors in a series circuit	**6. Constructing explanations (cont.)** ♦ Construct an explanation of the motion of an object based on a graph (e.g., position vs. time, velocity vs. time, acceleration vs. time, net force vs. time) ♦ Construct an explanation of the relationship between mass and inertia based on a variety of sources (e.g., model, research, simulation) ♦ Construct an explanation about how the gravitational forces that two objects exert on each other compare in magnitude and direction ♦ Apply scientific ideas or principles to design and construct a prototype of a circuit that meets given criteria ♦ Apply scientific ideas or principles to design and construct a prototype that minimizes the force on an object during a collision **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about the effectiveness of a safety device used in collisions (e.g., airbags, seatbelts, crushable bumpers, parachutes) ♦ Make and defend a claim based on scientific evidence about a design solution that will maximize the acceleration of an object ♦ Use scientific evidence to construct an argument about whether series or parallel circuits should be used in homes

ENTRY POINTS to Introductory Physics Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions (cont.)			**8. Obtaining, evaluating, and communicating information** ♦ Research, record, and/or present information showing how an object with the same mass can have different weights depending on the gravitational field ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how a technology/device uses magnetic fields and electrical currents to function (e.g., speaker, motor, fan, generator) ♦ Research, record, and/or present information comparing the forces between two masses and the forces between two charged objects ♦ Evaluate the validity of claims comparing series and parallel circuits
Energy	**1. Asking questions/defining problems** ♦ Generate a scientific question that is testable about how adding heat to a substance affects the temperature of the substance, using available resources ♦ Generate a scientific question that is testable about what factors affect the gravitational potential energy of an object, based on observations, models, simulations and/or results from an investigation ♦ Determine criteria and constraints to define a design problem that can be solved by designing a device that converts one form of energy to another	**3. Analyzing and interpreting data** ♦ Analyze data from a table or graph that includes the heights and masses of different objects to order the objects by the amount of gravitational potential energy of each object ♦ Create an appropriate visual representation of data (e.g., line graph, bar graph, table) to compare the efficiency of multiple devices ♦ Create appropriate visual representation of data (e.g., line graph, bar graph, table) to compare the kinetic energy, gravitational potential energy, and mechanical energy of an object in different locations as it moves along a track	**5. Developing and using models** ♦ Construct a model of the energy conversions within a device, including that some of the total energy put into the device is converted to thermal energy and sound energy ♦ Use a model of the particle motion and spatial arrangement in a substance to determine if the substance is a solid, liquid, or gas ♦ Evaluate a model of the electric field around 1- or 2-point charges to rank several locations in order of increasing field strength. ♦ Construct or revise models of particles in different phases

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)	**1. Asking questions/defining problems (cont.)** ♦ Evaluate a scientific question about the energy stored in the fields between two magnetic objects to determine if it is testable and/or relevant **2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to determine how adding heat to a substance affects the temperature of the substance, including that temperature is constant during a phase change ♦ Plan and/or follow the steps of an investigation to record the mass, speed, and height of an object in different locations along a track (e.g., to compare the kinetic and potential energy of the object as it moves along a track) ♦ Test a design solution to determine the input and output energy (e.g., "Rube Goldberg" device, roller coaster design) ♦ Select and use appropriate tools to conduct an investigation about the thermal energy transfer between two substances ♦ Plan and/or follow the steps of an investigation to determine the direction of the field between two magnets	**3. Analyzing and interpreting data (cont.)** ♦ Analyze data from a table or graph that includes the temperatures of two substances in thermal contact over time **4. Using mathematics and computational thinking** ♦ Use the formula, $KE = \frac{1}{2}mv^2$, to solve for the kinetic energy, mass, or speed of an object. ♦ Use the formula, $W = \triangle E = Fd$, to solve for the work done by a force to change an object's energy ♦ Apply mathematical concepts and/or processes (ratios, percentages, and/or basic operations) to determine the efficiency of a device when given the useful energy output from the device and the total energy put into the device ♦ Apply mathematical concepts and/or processes (proportions and/or basic operations) to compare the gravitational potential energy an object has at different heights ♦ Use the formula, $Q = mc\Delta T$, to solve for the heat transferred to/from a substance given the mass, specific heat, and change in temperature of the substance	**6. Constructing explanations** ♦ Construct an explanation about how the mechanical energy of an object may change due to friction/air resistance while the law of conservation of energy is still maintained, based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation about how forces that do work on an object can change the mechanical energy of the object, based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation about the thermal energy transfer between two substances in thermal contact, based on a variety of sources (e.g., model, research, investigation, simulation) **7. Engaging in argument from evidence** ♦ Use scientific evidence and observations to construct an argument about how the mechanical energy of an object remains constant when the only force acting on the object is gravity ♦ Make and defend a claim based on scientific evidence about whether work (i.e., energy transferred when an object is moved a distance by an external force) needs to be done on a test charge to move it within a given electric field ♦ Use scientific evidence and observations to construct an argument about how the materials selected for a design solution affect energy transfer

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Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)			**8. Obtaining, evaluating, and communicating information** ♦ Research, record, and/or present information about whether a device will operate correctly within given constraints to convert one form of energy to another ♦ Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how the average kinetic molecular motion of particles in a substance relate to the temperature of the substance ♦ Evaluate the validity and reliability of data from an investigation about thermal equilibrium
Waves and Their Applications in Techno-logies for Information Transfer	**1. Asking questions/defining problems** ♦ Generate a scientific question about waves that is testable using available resources ♦ Generate a scientific question that is testable based on observations, models, and/or results from an investigation about resonance, reflection, refraction, diffraction, or interference ♦ Determine criteria and constraints to define a design problem about a technology/ device that uses waves (e.g., radios, cell phones, microwaves)	**3. Analyzing and interpreting data** ♦ Analyze data from a table or graph to determine the relationship between frequency and energy of electromagnetic waves ♦ Analyze data from a table or graph to determine the relationship between frequency and wavelength when the speed of the wave is constant ♦ Analyze data from a table to compare the speeds of a sound wave through solids, liquids, and gases ♦ Analyze data from a table to compare the speed of an electromagnetic wave through a vacuum to the speed of the electromagnetic wave through a solid, liquid, or gas	**5. Developing and using models** ♦ Use a model of electromagnetic and mechanical waves to explain why mechanical waves cannot move through a vacuum ♦ Construct a model to explain the behavior of a wave (resonance, reflection, refraction, diffraction, interference) ♦ Use a model of transverse and longitudinal wave motion to identify key differences between the two ♦ Evaluate a wave model or a particle model of electromagnetic waves to determine light behaviors that can be explained by the model ♦ Construct a model to explain how a wave changes when it passes from one medium to another

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Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer (cont.)	**2. Planning and carrying out investigations** ♦ Plan and/or follow the steps of an investigation to determine the speed of a mechanical wave ♦ Select and use appropriate tools to conduct an investigation about how a wave changes when it travels from one medium to another (e.g., select and use a protractor to measure the angle of a refracted light wave) ♦ Select and/or create the appropriate table or organizer to collect data from an investigation about wave properties (frequency, wavelength, period, speed) ♦ Plan and/or follow the steps of an investigation to determine the result of two wave pulses interfering either constructively or destructively ♦ Plan and/or follow the steps of an investigation to determine how light reflects and refracts at the boundary between two media (e.g., from air to water or from clear plastic to air)	**3. Analyzing and interpreting data (cont.)** ♦ Create an appropriate visual representation of data (e.g., line graph, bar graph) to compare or analyze wave properties (frequency, wavelength, period, speed) **4. Using mathematics and computational thinking** ♦ Use the formula $v = \lambda f$ to solve for the speed, wavelength, or frequency of a wave ♦ Apply the mathematical concept for an inverse relationship ($f = \frac{1}{T}$) to solve for period or frequency ♦ Apply mathematical concepts and/or processes to a scale model of a wave to determine the wavelength or frequency of the wave ♦ Apply mathematic concepts and/or processes to a scale model of two wave pulses that interfere constructively and/or destructively to determine the amplitude of the pulses before, during, and after they are superimposed	**6. Constructing explanations** ♦ Construct an explanation of an observable phenomenon, including one or more wave behaviors (interference, diffraction, resonance, reflection, refraction), based on a variety of sources (e.g., model, research, investigation, simulation) ♦ Construct an explanation for how a technology/device (e.g., microwave, radio antenna, Wi-Fi) uses wave behaviors to function properly ♦ Construct an explanation for how an electron may be ejected from the surface of a metal by certain frequencies of light (photoelectric effect) **7. Engaging in argument from evidence** ♦ Make and defend a claim based on scientific evidence about why electromagnetic waves are needed to transmit information through a vacuum ♦ Use scientific evidence and observations to construct an argument about the health effects of using electromagnetic waves in technology/device (CT scans, x-rays, Wi-Fi) **8. Obtaining, evaluating, and communicating information** ♦ Research, record, and/or present information showing how the particle model or wave model explains a light phenomenon (photoelectric effect, resonance, reflection, refraction, diffraction, interference)

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Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Waves and Their Applications in Technologies for Information Transfer (cont.)			**8. Obtaining, evaluating, and communicating information (cont.)** ♦ Communicate (orally, graphically, textually) scientific information or ideas about phenomena related to wave behaviors (interference, diffraction, resonance, reflection, refraction) ♦ Evaluate the validity and reliability of a claim about wave behaviors (e.g., interference, diffraction, resonance, reflection, refraction) using a variety of resources (e.g., model, research, investigation, simulation)