MASSACHUSETTS
Department of Elementary
and Secondary Education

Alternate Academic Achievement Standards (AAAS) for the Massachusetts Curriculum Frameworks
(Resource Guide)

SCIENCE and TECHNOLOGY/ENGINEERING

Pre-Kindergarten–Grade 12

Updated Fall 2025

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

Pedro Martinez
Commissioner of Elementary and Secondary Education

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Introduction and Purpose

The Fall 2025 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 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)*

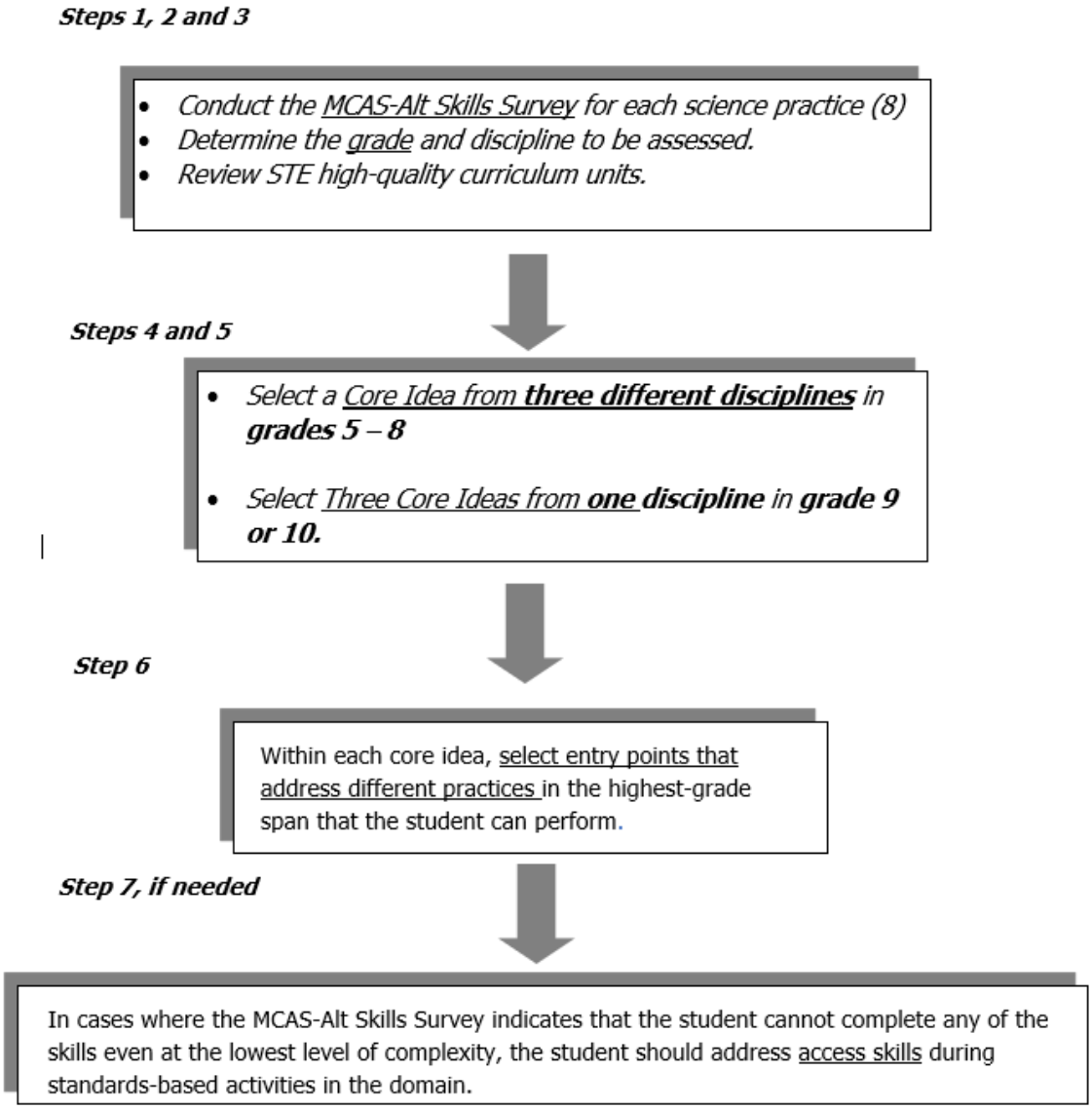
Developing and Using Models* *(to think about and make sense of an experience and make predictions, using 2-D and 3-D representations, constructions, displays, illustrations, and simulations)*

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 15–16	Pages 21–22	Pages 29–30	Pages 38–39
Earth's Systems	Pages 17–18	Pages 22–23	Pages 30–31	Pages 39–40
Earth and Human Activity	Pages 19–20	Pages 23–25	Pages 32–33	Pages 41–42

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Pre-Kindergarten

Core Idea	Learning Standard ID	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.
Earth's Place in the Universe	**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.
Earth's Systems	**PreK-ESS2-2(MA)**	Observe and classify non-living materials, natural and human made, in the local environment.
Earth's Systems	**PreK-ESS2-3(MA)**	Explore and describe different places water is found in the local environment.
Earth's Systems	**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.
Earth's Systems	**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.
Earth's Systems	**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.
Earth and Human Activity	**PreK-ESS3-2(MA)**	Observe and discuss the impact of people's activities on the local environment.

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Kindergarten

Core Idea	Learning Standard ID	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.
Earth's Systems	**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.
Earth and Human Activity	**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

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 1

Core Idea	Learning Standard ID	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.
Earth's Place in the Universe	**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 Standard ID	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.
Earth's Systems	**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.
Earth's Systems	**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.
Earth's Systems	**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

Instructions for creating access skills for Science and Technology/Engineering:

Select the access skill from **Step 1** and then choose and merge with content from the provided lists in **Step 2** for selected STE Core Idea.
Sample access skill for Core Idea of Earth's Place in the Universe:
Track materials in an activity related to questions about seasons and the Sun

Step 1: Select access skill student is addressing:

Access Skill:
○ Activate a device (within a specified amount of time) to participate in an activity related to…
○ Choose from an array of errorless choices (within a specified amount of time) to participate in an activity related to…
○ Grasp, release, or give materials in an activity related to…
○ Explore materials (tactilely) in an activity related to…
○ Track materials in an activity related to…
○ Functionally use materials in an activity related to…
○ Gain attention within a specified time block(s) to explore materials in an activity related to…
○ Imitate action in an activity related to…
○ Initiate cause and effect response in an activity related to…
○ Locate objects partially hidden or out of sight in an activity related to…
○ Make a request to explore materials in an activity related to…
○ Match object to object, or picture to picture of materials in an activity related to…
○ Move materials in an activity related to…
○ Orient or manipulate materials or a model in an activity related to…
○ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials in an activity related to…
○ Turn on/off technology within a specified amount of time in an activity related to…

ACCESS SKILLS to
Earth and Space Sciences Standards

Step 2: Choose the practice in which data will be collected on the skill:

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Place in the Universe	**1. Asking questions/defining problems** ***Topic: Earth, Moon, and Sun*** • questions about the Earth, Moon and Sun ***Topic: Fossils and Rock Layers*** • questions about fossils and rock layers ***Topic: Landforms*** • questions about landforms ***Topic: Seasons and the Sun*** • questions about seasons and the Sun **2. Planning and carrying out investigations** ***Topic: Earth, Moon, and Sun*** • investigations regarding the Earth, Moon, and Sun ***Topic: Fossils and Rock Layers*** • investigations regarding fossils and rock layers ***Topic: Landforms*** • investigations regarding landforms ***Topic: Seasons and the Sun*** • investigations regarding seasons and the Sun	**3. Analyzing and interpreting data** ***Topic: Earth, Moon, and Sun*** • data about the Earth, Moon and Sun ***Topic: Fossils and Rock Layers*** • data about fossils and rock layers ***Topic: Landforms*** • data about landforms ***Topic: Seasons and the Sun*** • data about questions about seasons and the Sun **4. Using mathematics and computational thinking** ***Topic: Earth, Moon, and Sun*** • counting or numbers regarding the Earth, Moon, and Sun ***Topic: Fossils and Rock Layers*** • counting or numbers regarding fossils and rock layers ***Topic: Landforms*** • counting or numbers regarding landforms ***Topic: Seasons and the Sun*** • counting or numbers regarding seasons and the Sun	**5. Developing and using models** ***Topic: Earth, Moon, and Sun*** • models involving the Earth, Moon and Sun ***Topic: Fossils and Rock Layers*** • models involving fossils and rock layers ***Topic: Landforms*** • models involving landforms ***Topic: Seasons and the Sun*** • models involving seasons and the Sun **6. Constructing explanations** ***Topic: Earth, Moon, and Sun*** • terminology about the Earth, Moon, and Sun ***Topic: Fossils and Rock Layers*** • terminology about fossils and rock layers ***Topic: Landforms*** • terminology about landforms ***Topic: Seasons and the Sun*** • terminology about seasons and the Sun

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.)			**7. Engaging in argument from evidence** ***Topic: Earth, Moon, and Sun*** • facts about the Earth, Moon, and Sun ***Topic: Fossils and Rock Layers*** • facts about fossils and rock layers ***Topic: Landforms*** • facts about landforms ***Topic: Seasons and the Sun*** • facts about seasons and the Sun **8. Obtaining, evaluating, and communicating information** ***Topic: Earth, Moon, and Sun*** • sharing information about the Earth, Moon, and Sun ***Topic: Fossils and Rock Layers*** • sharing information about fossils and rock layers ***Topic: Landforms*** • sharing information about landforms ***Topic: Seasons and the Sun*** • sharing information about seasons and the Sun

ACCESS SKILLS to
Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems	**1. Asking questions/defining problems** ***Topic: Earth's Changing Surface*** • questions about the Earth's changing surface ***Topic: Seasons Around Us*** • questions about seasons around us ***Topic: The Water Cycle*** • questions about the water cycle ***Topic: Weather*** • questions about weather ***Topic: Weather and Climate*** • questions about weather and climate **2. Planning and carrying out investigations** ***Topic: Earth's Changing Surface*** • investigations regarding the Earth's changing surface ***Topic: Seasons Around Us*** • investigations regarding seasons around us ***Topic: The Water Cycle*** • investigations regarding the water cycle ***Topic: Weather*** • investigations regarding weather ***Topic: Weather and Climate*** • investigations regarding weather and climate	**3. Analyzing and interpreting data** ***Topic: Earth's Changing Surface*** • data about the Earth's changing surface ***Topic: Seasons Around Us*** • data about seasons around us ***Topic: The Water Cycle*** • data about the water cycle ***Topic: Weather*** • data about weather ***Topic: Weather and Climate*** • data about weather and climate **4. Using mathematics and computational thinking** ***Topic: Earth's Changing Surface*** • counting or numbers regarding the Earth's changing surface ***Topic: Seasons Around Us*** • counting or numbers regarding seasons around us ***Topic: The Water Cycle*** • counting or numbers regarding the water cycle ***Topic: Weather*** • counting or numbers regarding weather ***Topic: Weather and Climate*** • counting or numbers regarding weather and climate	**5. Developing and using models** ***Topic: Earth's Changing Surface*** • models involving the Earth's changing surface ***Topic: Seasons Around Us*** • models involving seasons around us ***Topic: The Water Cycle*** • models involving the water cycle ***Topic: Weather*** • models involving weather ***Topic: Weather and Climate*** • models involving weather and climate **6. Constructing explanations** ***Topic: Earth's Changing Surface*** • terminology about the Earth's changing surface ***Topic: Seasons Around Us*** • terminology about seasons around us ***Topic: The Water Cycle*** • terminology about the water cycle ***Topic: Weather*** • terminology about weather ***Topic: Weather and Climate*** • terminology about weather and climate

ACCESS SKILLS to
Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth's Systems (cont.)			**7. Engaging in argument from evidence** ***Topic: Earth's Changing Surface*** • facts about the Earth's changing surface ***Topic: Seasons Around Us*** • facts about seasons around us ***Topic: The Water Cycle*** • facts about the water cycle ***Topic: Weather*** • facts about weather ***Topic: Weather and Climate*** • facts about weather and climate **8. Obtaining, evaluating, and communicating information** ***Topic: Earth's Changing Surface*** • sharing information about the Earth's changing surface ***Topic: Seasons Around Us*** • sharing information about seasons around us ***Topic: The Water Cycle*** • sharing information about the water cycle ***Topic: Weather*** • sharing information about weather ***Topic: Weather and Climate*** • sharing information about weather and climate

ACCESS SKILLS to
Earth and Space Sciences Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Earth and Human Activity	**1. Asking questions/defining problems** ***Topic: Climate Change*** • questions about climate change ***Topic: Preparing for Weather*** • questions about preparing for weather ***Topic: Natural Resource Consumption*** • questions about natural resource consumption ***Topic: Pollution*** • questions about pollution ***Topic: Reusing, Reducing and Recycling*** • questions about reusing, reducing, and recycling ***Topic: Water Filtration*** • questions about water filtration **2. Planning and carrying out investigations** ***Topic: Climate Change*** • investigations regarding climate change ***Topic: Preparing for Weather*** • investigations regarding preparing for weather ***Topic: Natural Resource Consumption*** • investigations regarding natural resource consumption ***Topic: Pollution*** • investigations regarding pollution ***Topic: Reusing, Reducing and Recycling*** • investigations regarding reusing, reducing, and recycling ***Topic: Water Filtration*** • investigations regarding water filtration	**3. Analyzing and interpreting data** ***Topic: Climate Change*** • data about climate change ***Topic: Preparing for Weather*** • data about preparing for weather ***Topic: Natural Resource Consumption*** • data about natural resource consumption ***Topic: Pollution*** • data about pollution ***Topic: Reusing, Reducing and Recycling*** • data about reusing, reducing, and recycling ***Topic: Water Filtration*** • data about water filtration **4. Using mathematics and computational thinking** ***Topic: Climate Change*** • counting or numbers regarding climate change ***Topic: Preparing for Weather*** • counting or numbers regarding preparing for weather ***Topic: Natural Resource Consumption*** • counting or numbers regarding natural resource consumption ***Topic: Pollution*** • counting or numbers regarding pollution ***Topic: Reusing, Reducing and Recycling*** • counting or numbers regarding reusing, reducing, and recycling ***Topic: Water Filtration*** • counting or numbers regarding water filtration	**5. Developing and using models** ***Topic: Climate Change*** • models involving climate change ***Topic: Preparing for Weather*** • models involving preparing for weather ***Topic: Natural Resource Consumption*** • models involving natural resource consumption ***Topic: Pollution*** • models involving pollution ***Topic: Reusing, Reducing and Recycling*** • models involving reusing, reducing, and recycling ***Topic: Water Filtration*** • models involving water filtration **6. Constructing explanations** ***Topic: Climate Change*** • terminology about climate change ***Topic: Preparing for Weather*** • terminology about preparing for weather ***Topic: Natural Resource Consumption*** • terminology about natural resource consumption ***Topic: Pollution*** • terminology about pollution ***Topic: Reusing, Reducing and Recycling*** • terminology about reusing, reducing, and recycling ***Topic: Water Filtration*** • terminology about water filtration

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.)			**7. Engaging in argument from evidence** ***Topic: Climate Change*** • facts about climate change ***Topic: Preparing for Weather*** • facts about preparing for weather ***Topic: Natural Resource Consumption*** • facts about natural resource consumption ***Topic: Pollution*** • facts about pollution ***Topic: Reusing, Reducing and Recycling*** • facts about reusing, reducing, and recycling ***Topic: Water Filtration*** • facts about water filtration **8. Obtaining, evaluating, and communicating information** ***Topic: Climate Change*** • sharing information about climate change ***Topic: Preparing for Weather*** • sharing information about preparing for weather ***Topic: Natural Resource Consumption*** • sharing information about natural resource consumption ***Topic: Pollution*** • sharing information about pollution ***Topic: Reusing, Reducing and Recycling*** • sharing information about reusing, reducing, and recycling ***Topic: Water Filtration*** • sharing information about water filtration

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** ***Topic: Earth, Moon, and Sun*** • 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 ***Topic: Seasons and the Sun*** • Record relevant questions about how the amount of daylight changes in different seasons based on observations or other media sources **2. Planning and carrying out investigations** ***Topic: Earth, Moon, and Sun*** • 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 ***Topic: Seasons and the Sun*** • Record data based on observations related to how the amount of daylight changes in different seasons	**3. Analyzing and interpreting data** ***Topic: Earth, Moon, and Sun*** • Compare predictions to the data and/or observations from an investigation about the movement of the Sun, Moon, and stars across the sky ***Topic: Seasons and the Sun*** • Display data using a simple graph, table, or pictures to show how the amount of daylight changes in different seasons **4. Using mathematics and computational thinking** ***Topic: Earth, Moon, and Sun*** • 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 ***Topic: Seasons and the Sun*** • Use counting and numbers to show data about the times of sunrise and sunset over a period of time	**5. Developing and using models** ***Topic: Earth, Moon, and Sun*** • 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 ***Topic: Seasons and the Sun*** • 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) **6. Constructing explanations** ***Topic: Earth, Moon, and Sun*** • 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) ***Topic: Seasons and the Sun*** • Describe how the duration of daylight changes with each season **7. Engaging in argument from evidence** ***Topic: Earth, Moon, and Sun*** • 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 ***Topic: Seasons and the Sun*** • Use scientific evidence in support of an argument about how the duration of daylight changes with each season

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.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Earth, Moon, and Sun*** ♦ Recall and present information from observations, text, or media source about the different locations of the Sun in the sky during the day ***Topic: Seasons and the Sun*** ♦ Recall and present information from observations, text, or media source about seasonal changes in the amount/duration of daylight
Earth's Systems	**1. Asking questions/defining problems** ***Topic: Seasons Around Us*** • Record relevant questions about seasonal change based on observations ***Topic: Weather*** • Identify questions that can be answered by an investigation about how local weather changes **2. Planning and carrying out investigations** ***Topic: Seasons Around Us*** • Use pictures and/or drawings to collect observations related to the seasons ***Topic: Weather*** • 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) • Record observations (e.g., first-hand experiences, media) to collect data about local weather • Use pictures and/or drawings to collect observations related to weather conditions (e.g., sunny, cloudy, rainy, windy)	**3. Analyzing and interpreting data** ***Topic: Seasons Around Us*** • Display data using a simple graph, table, or pictures to show temperature readings to compare typical seasonal conditions ***Topic: Weather*** • Group information/data about the weather and its effects on plants and animals to identify patterns (e.g., water and shelter) • Compare predictions to the data and/or observations from an investigation about different weather conditions • Display data using a simple graph, table, or pictures to show temperature reading to compare various forms of precipitation	**5. Developing and using models** ***Topic: Seasons Around Us*** • Illustrate, construct, and/or label a model to show how seasonal changes impact the environment ***Topic: Weather*** • Illustrate, construct, and/or label a model to show how local weather changes **6. Constructing explanations** ***Topic: Seasons Around Us*** • Describe characteristics of typical seasonal weather patterns (e.g., winter is snowy, summer is hot) • Describe how seasonal changes impact the environment ***Topic: Weather*** • Describe appropriate responses to different weather conditions (e.g., it is cold – I need my coat)

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.)		**4. Using mathematics and computational thinking** ***Topic: Seasons Around Us*** • Use counting and numbers to show data about seasonal patterns ***Topic: Weather*** • Use counting and numbers to show data about daily weather, including precipitation, sunny/cloudy, temperature, and rain/snow • Identify the qualitative and quantitative information about weather's impact on animals and plants • Identify the qualitative and quantitative information local weather conditions (sunny/cloudy, temperature, and rain/snow)	**7. Engaging in argument from evidence** ***Topic: Seasons Around Us*** • Use scientific evidence in support of an argument about how seasonal changes impact the environment ***Topic: Weather*** • Use scientific evidence in support of an argument about weather's impact on animals and plants **8. Obtaining, evaluating, and communicating information** ***Topic: Seasons Around Us*** • Communicate scientific information or ideas about seasonal changes ***Topic: Weather*** • Communicate scientific information or ideas about local weather patterns • Communicate scientific information or ideas about local weather conditions
Earth and Human Activity	**1. Asking questions/defining problems** ***Topic: Preparing for Weather*** • Record relevant questions about how to prepare for different weather based on a forecast • Define a simple problem related to how to prepare for different weather based on a forecast ***Topic: Reusing, Reducing and Recycling*** • Identify questions that can be answered by an investigation about recycling or reusing resources	**3. Analyzing and interpreting data** ***Topic: Preparing for Weather*** • Display data using a simple graph or picture to show ways in which people prepare for different weather conditions ***Topic: Reusing, Reducing and Recycling*** • 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** ***Topic: Preparing for Weather*** • Illustrate, construct, and/or label a model to show/explain how weather forecasting can help people prepare for specific types of weather ***Topic: Reusing, Reducing and Recycling*** • Illustrate, construct, and/or label a model to show/explain the ways in which individuals conserve natural resources (e.g., reusing, recycling, repurposing)

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.)	**2. Planning and carrying out investigations** ***Topic: Preparing for Weather*** • Use pictures and/or drawings to collect observations related to ways in which people prepare for different weather conditions ***Topic: Reusing, Reducing and Recycling*** • 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)	**4. Using mathematics and computational thinking** ***Topic: Preparing for Weather*** • 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) ***Topic: Reusing, Reducing and Recycling*** • Use counting and numbers to show data about the frequency of recycling items (e.g., locally, classroom)	**6. Constructing explanations** ***Topic: Preparing for Weather*** • 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.) ***Topic: Reusing, Reducing and Recycling*** • Describe the ways in which individuals can reduce the consumption of natural resources (e.g., reusing, recycling, repurposing) • 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** ***Topic: Preparing for Weather*** • Use scientific evidence in support of an argument about ways in which people prepare for different weather conditions ***Topic: Reusing, Reducing and Recycling*** • Use scientific evidence in support of an argument about how individuals can reduce the consumption of natural resources (e.g., by reusing, recycling, repurposing, or reducing use)

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.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Preparing for Weather*** • Recall and present information from observations, text, or media source about how weather forecasting can help people plan for specific types of weather ***Topic: Reusing, Reducing and Recycling*** • Recall and present information from observations, text, or media source about solutions that reduce the consumption of natural resources (e.g., reusing, recycling, repurposing)

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 3

Core Idea	Learning Standard ID	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.
Earth's Systems	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 4

Core Idea	Learning Standard ID	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.
Earth's Systems	**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.
Earth and Human Activity	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 5

Core Idea	Learning Standard ID	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.
Earth's Place in the Universe	**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.
Earth's Systems	**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.
Earth and Human Activity	**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** ***Topic: Earth, Moon & Sun*** • 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 ***Topic: Landforms*** • Use observations and/or data to ask relevant questions about landforms and how they were created **2. Planning and carrying out investigations** ***Topic: Earth, Moon & Sun*** • Record observations (e.g., first-hand experiences, media) to collect data related to how the Earth's relationship with the Sun affects day and night on the Earth's surface ***Topic: Landforms*** • Plan and/or follow the steps of an investigation to collect data and/or observations about landforms and how they are created	**3. Analyzing and interpreting data** ***Topic: Earth, Moon & Sun*** • 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 ***Topic: Landforms*** • Compare predictions to the data and/or observations from an investigation about landforms and how they were created **4. Using mathematics and computational thinking** ***Topic: Earth, Moon & Sun*** • Use counting and numbers to show data about the changes in the number of hours of daylight versus night during the year ***Topic: Landforms*** • Organize the qualitative and quantitative information about changes in landforms over time (e.g., timeline of events)	**5. Developing and using models** ***Topic: Earth, Moon & 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 ***Topic: Landforms*** • Illustrate or develop a model to show/explain how simple landforms are created **6. Constructing explanations** ***Topic: Earth, Moon & Sun*** • Describe the duration of day and night based on the season and the position of Earth relative to the sun ***Topic: Landforms*** • Explain how simple landforms are created and change over time **7. Engaging in argument from evidence** ***Topic: Earth, Moon & Sun*** • Use scientific evidence in support of a claim that the position of the Earth and Sun cause day and night to occur ***Topic: Landforms*** • Use scientific evidence in support of a claim that landforms change over time

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.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Earth, Moon & Sun*** • Research and present information showing how the Earth's relationship to the Sun affects day and night ***Topic: Landforms*** • Research and present information showing how landforms change over time
Earth's Systems	**1. Asking questions/defining problems** ***Topic: Earth's Changing Surface*** • Identify questions that can be answered by an investigation about weathering and erosion ***Topic: The Water Cycle*** • Use observations and/or data to ask relevant questions about the water cycle • Identify questions that can be answered by an investigation about the water cycle ***Topic: Weather and Climate*** • Use observations and/or data to ask relevant questions about weather patterns (e.g., comparing seasons, comparing locations, typical local weather) • Generate scientific questions about climates in different regions of the Earth	**3. Analyzing and interpreting data** ***Topic: Earth's Changing Surface*** • Use data and/or observations to identify patterns about how landforms are affected by weathering and erosion over time ***Topic: The Water Cycle*** • Use data and/or observations to identify patterns about the water cycle • Compare predictions to the data and/or observations from an investigation about the water cycle ***Topic: Weather and Climate*** • 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)	**5. Developing and using models** ***Topic: Earth's Changing Surface*** • Illustrate or develop a model to show/explain changes in the Earth's surface due to erosion and weathering ***Topic: The Water Cycle*** • Illustrate or develop a model to show/explain the water cycle ***Topic: Weather and Climate*** • Compare models of climates of different regions of the world to illustrate typical weather conditions (e.g., polar/cold compared to tropical/hot) **6. Constructing explanations** ***Topic: Earth's Changing Surface*** • Explain the difference between weathering and erosion ***Topic: The Water Cycle*** • Describe the cycling of water and its components (evaporation, precipitation, absorption, surface runoff, and condensation) ***Topic: Weather and Climate*** • Explain how the climate data (e.g., average temperature, precipitation) varies in different seasons for different regions

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** ***Topic: Earth's Changing Surface*** • Plan and/or follow the steps of an investigation to collect data and/or observations about erosion and weathering • Identify examples of changes to the Earth's surface due to erosion or weathering, based on data recorded from observations and/or research ***Topic: The Water Cycle*** • Plan and/or follow the steps of an investigation to collect data and/or observations about the water cycle • Record observations (e.g. first-hand experiences, media) to collect data related to the water cycle ***Topic: Weather and Climate*** • Select the best method to collect data and/or observations about weather patterns • Record observations (e.g., first-hand experiences, media) to collect data related to climates in different regions of the Earth	**4. Using mathematics and computational thinking** ***Topic: Earth's Changing Surface*** • Organize the qualitative and quantitative information about changes in the Earth's surface due to erosion and weathering ***Topic: The Water Cycle*** • Use counting and numbers to show data about the movement of water during the water cycle ***Topic: Weather and Climate*** • 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	**7. Engaging in argument from evidence** ***Topic: Earth's Changing Surface*** • Use scientific evidence to support a claim about changes in the Earth's surface due to erosion and weathering ***Topic: The Water Cycle*** • Use scientific evidence to support a claim about the movement of water in the water cycle ***Topic: Weather and Climate*** • Use scientific evidence to support a claim that typical weather conditions can vary by climate region **8. Obtaining, evaluating, and communicating information** ***Topic: Earth's Changing Surface*** • Research and present information from an investigation about the changes in the Earth's surface due to erosion and/or weathering ***Topic: The Water Cycle*** • Research and present information from an investigation about the water cycle • Communicate scientific information (orally, graphically, textually and/or mathematically) about the water cycle ***Topic: Weather and Climate*** • Communicate scientific information (orally, graphically, textually, and/or mathematically) about local weather in a particular season • Communicate scientific information (orally, graphically, textually, and/or mathematically) about the climate of different regions of the world (e.g., typical weather conditions)

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	**1. Asking questions/defining problems** ***Topic: Pollution*** • Use observations and/or data to ask relevant questions about impact of human activities on the environment • Identify questions that can be answered by an investigation about how pollution or runoff is caused by human impact ***Topic: Water Filtration*** • Define a simple problem that can be solved related to filtering water **2. Planning and carrying out investigations** ***Topic: Pollution*** • Record observations (e.g., first-hand experiences, media) to collect data related to how communities can reduce the human impact on Earth's resources and environment ***Topic: Water Filtration*** • 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)	**3. Analyzing and interpreting data** ***Topic: Pollution*** • Use data and/or observations to identify relationships between the impact of human activities and the environment (e.g., pollution, runoff) ***Topic: Water Filtration*** • Compare predictions to the data and/or observations from an investigation related to filtering particles from water **4. Using mathematics and computational thinking** ***Topic: Pollution*** • Organize the qualitative and quantitative information about the impact of human activities and the environment (e.g. pollution, runoff) ***Topic: Water Filtration*** • Use counting and numbers to show data about the effectiveness of a water filter	**5. Developing and using models** ***Topic: Pollution*** • Illustrate or develop a model to show/explain the impact of human activities and the environment (e.g., pollution, runoff) ***Topic: Water Filtration*** • Illustrate or develop a model to show/explain the best solution for filtering particles out of water **6. Constructing explanations** ***Topic: Pollution*** • Describe how agricultural and industrial pollution impact the environment ***Topic: Water Filtration*** • Use tools and/or materials to build a device that solves a specific problem about filtering particles out of water **7. Engaging in argument from evidence** ***Topic: Pollution*** • 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 ***Topic: Water Filtration*** • Use scientific evidence to support a claim for or against a design solution about the effectiveness of a water filter

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** ***Topic: Pollution*** • 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 ***Topic: Water Filtration*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about different solutions that filter particles out of water

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 6

Core Idea	Learning Standard ID	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.
Earth's Place in the Universe	**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.
Earth's Place in the Universe	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 7

Core Idea	Learning Standard ID	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.
Earth's Systems	**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.
Earth and Human Activity	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Earth and Space Sciences

Grade Level: Grade 8

Core Idea	Learning Standard ID	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.
Earth's Place in the Universe	**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
Earth's Systems	**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.
Earth's Systems	**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 Standard ID	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).
Earth and Human 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** ***Topic: Earth, Moon and Sun*** • 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) • Identify scientific (testable) and non-scientific (non-testable) questions about the phases of the Moon after making observations ***Topic: Fossils & Rock Layers*** • 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** ***Topic: Earth, Moon and Sun*** • Plan and/or conduct and investigation about the cause of the phases of the moon over the course of a month ***Topic: Fossils & Rock Layers*** • 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	**3. Analyzing and interpreting data** ***Topic: Earth, Moon and Sun*** • 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 • 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) ***Topic: Fossils & Rock Layers*** • Analyze and interpret data about the age of various rock layers containing fossils (e.g., laws of superposition, cross cutting relationships) **4. Using mathematics and computational thinking** ***Topic: Earth, Moon and Sun*** • Organize simple data sets to reveal patterns about the cause of the phases of the moon over the course of a month • 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 ***Topic: Fossils & Rock Layers*** • Use computations (e.g., addition, subtraction) to analyze data (e.g., averages, totals, differences) about fossils	**5. Developing and using models** ***Topic: Earth, Moon and Sun*** • 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 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 ***Topic: Fossils & Rock Layers*** • Develop, revise and/or use a model to show/explain the relative age of fossils found in layers of rock **6. Constructing explanations** ***Topic: Earth, Moon and Sun*** • Draw conclusions based on multiple pieces of evidence (e.g., from investigations) about the cause of lunar phases or eclipses ***Topic: Fossils & Rock Layers*** • Draw conclusions based on multiple pieces of evidence about the ages of various rock layers (e.g., based on fossils) **7. Engaging in argument from evidence** ***Topic: Earth, Moon and Sun*** • Critique an argument citing evidence from informational sources about the causes of eclipses or lunar phases • Critique an argument citing evidence from informational sources about the cause of seasonal changes ***Topic: Fossils & Rock Layers*** • Defend a claim that the ages of rock formations can be determined by using fossils as evidence

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			**8. Obtaining, evaluating, and communicating information** ***Topic: Earth, Moon and Sun*** • 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 ***Topic: Fossils & Rock Layers*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the ages of various rock layers (e.g., based on fossils)
Earth's Systems	**1. Asking questions/defining problems** ***Topic: Earth's Changing Surface*** • Generate scientific questions about the locations of volcanic and/or earthquake activity based on research and/or observations ***Topic: Weather and Climate*** • Ask questions about what would happen if a variable was changed in an investigation about weather (e.g., temperature, humidity, wind) • Generate scientific questions about ocean currents and how they affect weather and climate in different regions based on research and/or observations	**3. Analyzing and interpreting data** ***Topic: Earth's Changing Surface*** • Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the locations of earthquakes and volcanos ***Topic: Weather and Climate*** • 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	**5. Developing and using models** ***Topic: Earth's Changing Surface*** • Develop, revise, and/or use a model to show/explain the movement of Earth's crustal plates ***Topic: Weather and Climate*** • 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 Nino) • Develop, revise, and/or use a model to show/explain how local weather is affected by patterns of movement of air masses

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** ***Topic: Earth's Changing Surface*** • 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 the movement of Earth's crustal plates (e.g., distribution of fossils, earthquakes, volcanos, landforms) ***Topic: Weather and Climate*** • 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	**4. Using mathematics and computational thinking** ***Topic: Earth's Changing Surface*** • 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) ***Topic: Weather and Climate*** • Organize simple data sets to reveal patterns about weather including temperature, humidity, and precipitation • Use computations (e.g., addition, subtraction, division, multiplication) to analyze data (e.g., averages, totals, differences) about weather	**6. Constructing explanations** ***Topic: Earth's Changing Surface*** • Explain how certain features of the earth formed the way they did (e.g., lakes, ocean trenches, mountains, canyons) • Explain how convection results in the shifting of Earth's crustal plates (e.g., plate tectonics) ***Topic: Weather and Climate*** • Explain the relationship between the ocean and weather (e.g., prevailing winds, ocean currents) **7. Engaging in argument from evidence** ***Topic: Earth's Changing Surface*** • Compare and critique two arguments about how certain features of the Earth formed the way they did (e.g., volcanoes, ocean trenches) ***Topic: Weather and Climate*** • 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** ***Topic: Earth's Changing Surface*** • Combine scientific information from multiple sources to explain the effects of the movement of the Earth's crustal plates (e.g., landforms, earthquakes) ***Topic: Weather and Climate*** • 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)

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	**1. Asking questions/defining problems** ***Topic: Climate Change*** • 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 ***Topic: Natural Resource Consumption*** • Ask questions about what would happen if the human population continues to increase and natural resources (e.g., water, energy supplies) continue to diminish • 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** ***Topic: Climate Change*** • Analyze and interpret data to make sense of the rise in global temperatures ***Topic: Natural Resource Consumption*** • Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the Earth's mineral and fossil fuel 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) **4. Using mathematics and computational thinking** ***Topic: Climate Change*** • 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) ***Topic: Natural Resource Consumption*** • Organize simple data sets to reveal patterns the depletion of natural resources (e.g., water, mineral, and energy supplies)	**5. Developing and using models** ***Topic: Climate Change*** • 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) ***Topic: Natural Resource Consumption*** • 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 **6. Constructing explanations** ***Topic: Climate Change*** • Generate and compare multiple solutions to a problem related to climate change ***Topic: Natural Resource Consumption*** • 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

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	**2. Planning and carrying out investigations** ***Topic: Climate Change*** • 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 • 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) ***Topic: Natural Resource Consumption*** • Plan and/or conduct an investigation about human population and per capita consumption of natural resources to produce data/observations to serve as evidence • Record observations to produce data about how human activities have caused a depletion of natural resources (e.g., water, mineral, and energy supplies)		**7. Engaging in argument from evidence** ***Topic: Climate Change*** • 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) ***Topic: Natural Resource Consumption*** • Use scientific evidence and observations to construct an argument about a method to slow the depletion of natural resources **8. Obtaining, evaluating, and communicating information** ***Topic: Climate Change*** • Combine scientific information from multiple sources to explain how human activities may have caused global climate change • Research and present information on how human activities, such as deforestation, agriculture, and combustion of fossil fuels, has contributed to global climate change ***Topic: Natural Resource Consumption*** • 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)

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 49–50	Pages 58–61	Pages 72–73	Pages 85–86
Ecosystems: Interactions, Energy, and Dynamics	Pages 51–52	Pages 62–63	Page 74	Pages 87–88
Heredity: Inheritance and Variation of Traits	Pages 53–54	Pages 64–65	Page 75	Page 89
Biological Evolution: Unity and Diversity	Pages 55–56	Pages 66–67	Pages 76–78	Pages 90–91

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Pre-Kindergarten

Core Idea	Learning Standard ID	Learning Standards as written
From Molecules to Organisms	**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.
From Molecules to Organisms	**PreK-LS1-2(MA)**	Explain that most animals have five senses they use to gather information about the world around them.
From Molecules to Organisms	**PreK-LS1-3(MA)**	Use their five senses in their exploration and play to gather information.
Ecosystems	**PreK-LS2-1(MA)**	Use evidence from animals and plants to define several characteristics of living things that distinguish them from non-living things.
Ecosystems	**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.
Ecosystems	**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	**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.
Heredity	**PreK-LS3-2(MA)**	Use observations to recognize differences and similarities among themselves and their friends.

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Pre-Kindergarten

Core Idea	Learning Standard ID	Learning Standards as written
From Molecules to Organisms	**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.
From Molecules to Organisms	**K-LS1-2(MA)**	Recognize that all plants and animals grow and change over time.

Grade Level: Grade 1

Core Idea	Learning Standard ID	Learning Standards as written
From Molecules to Organisms	**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.
From Molecules to Organisms	**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	**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 Standard ID	Learning Standards as written
Ecosystems	**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	**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

Instructions for creating access skills for Science and Technology/Engineering:

Select the access skill from **Step 1** and then choose and merge with content from the provided lists in **Step 2** for selected STE Core Idea.
Sample access skill for Core Idea of From Molecules to Organisms:

- *Move materials in an activity related to questions about body systems.*

Step 1: Select access skill student is addressing:

Access Skill:
○ Activate a device (within a specified amount of time) to participate in an activity related to…
○ Choose from an array of errorless choices (within a specified amount of time) to participate in an activity related to…
○ Grasp, release, or give materials in an activity related to…
○ Explore materials (tactilely) in an activity related to…
○ Track materials in an activity related to…
○ Functionally use materials in an activity related to…
○ Gain attention within a specified time block(s) to explore materials in an activity related to…
○ Imitate action in an activity related to…
○ Initiate cause and effect response in an activity related to…
○ Locate objects partially hidden or out of sight in an activity related to…
○ Make a request to explore materials in an activity related to…
○ Match object to object, or picture to picture of materials in an activity related to…
○ Move materials in an activity related to…
○ Orient or manipulate materials or a model in an activity related to…
○ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials in an activity related to…
○ Turn on/off technology within a specified amount of time in an activity related to…

ACCESS SKILLS to
Life Science Standards

Step 2: Choose the Core Idea content/topic in which data will be collected on the skill:

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
From Molecules to Organisms: Structures and Processes	**1. Asking questions/defining problems** ***Topic: Body Systems*** • questions about body systems ***Topic: Cells and Cell Structures*** • questions about cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • questions about environmental impacts on growth and survival ***Topic: Five Senses*** • questions about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • questions about life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • questions about plant and animal structures	**3. Analyzing and interpreting data** ***Topic: Body Systems*** • data about body systems ***Topic: Cells and Cell Structures*** • data about cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • data about environmental impacts on growth and survival ***Topic: Five Senses*** • data about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • data about life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • data about plant and animal structures	**5. Developing and using models** ***Topic: Body Systems*** • models involving body systems ***Topic: Cells and Cell Structures*** • models involving cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • models involving environmental impacts on growth and survival ***Topic: Five Senses*** • models involving the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • models involving life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • models involving plant and animal structures

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** ***Topic: Body Systems*** • investigations regarding body systems ***Topic: Cells and Cell Structures*** • investigations regarding cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • investigations regarding environmental impacts on growth and survival ***Topic: Five Senses*** • investigations regarding the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • investigations regarding life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • investigations regarding plant and animal structures	**4. Using mathematics and computational thinking** ***Topic: Body Systems*** • counting or numbers regarding body systems ***Topic: Cells and Cell Structures*** • counting or numbers regarding cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • counting or numbers regarding environmental impacts on growth and survival ***Topic: Five Senses*** • counting or numbers regarding the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • counting or numbers regarding life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • counting or numbers regarding plant and animal structures	**6. Constructing explanations** ***Topic: Body Systems*** • terminology about body systems ***Topic: Cells and Cell Structures*** • terminology about cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • terminology about environmental impacts on growth and survival ***Topic: Five Senses*** • terminology about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • terminology about life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • terminology about plant and animal structures

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.)			**7. Engaging in argument from evidence** ***Topic: Body Systems*** • facts about body systems ***Topic: Cells and Cell Structures*** • facts about cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • facts about environmental impacts on growth and survival ***Topic: Five Senses*** • facts about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • facts about life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • facts about plant and animal structures

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** ***Topic: Body Systems*** • sharing information about body systems ***Topic: Cells and Cell Structures*** • sharing information about cells and cell structures ***Topic: Environmental Impacts on Growth and Survival*** • sharing information about environmental impacts on growth and survival ***Topic: Five Senses*** • sharing information about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • sharing information about life cycles, growth, and reproduction ***Topic: Plant and Animal Structures*** • sharing information about plant and animal structures

ACCESS SKILLS to
Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics	**1. Asking questions/defining problems** ***Topic: Ecological Relationships*** • questions about ecological relationships ***Topic: Living and Non-Living Things*** • questions about living and non-living things ***Topic: Movement of Matter*** • questions about the movement of matter ***Topic: Movement of Matter and Energy*** • questions about the movement of matter and energy ***Topic: Plant and Animal Needs*** • questions about plant and animal needs **2. Planning and carrying out investigations** ***Topic: Ecological Relationships*** • investigations regarding ecological relationships ***Topic: Living and Non-Living Things*** • investigations regarding living and non-living things ***Topic: Movement of Matter*** • investigations regarding the movement of matter ***Topic: Movement of Matter and Energy*** • investigations regarding the movement of matter and energy ***Topic: Plant and Animal Needs*** • investigations regarding plant and animal needs	**3. Analyzing and interpreting data** ***Topic: Ecological Relationships*** • data about ecological relationships ***Topic: Living and Non-Living Things*** • data about living and non-living things ***Topic: Movement of Matter*** • data about the movement of matter ***Topic: Movement of Matter and Energy*** • data about the movement of matter and energy ***Topic: Plant and Animal Needs*** • data about plant and animal needs **4. Using mathematics and computational thinking** ***Topic: Ecological Relationships*** • counting or numbers regarding ecological relationships ***Topic: Living and Non-Living Things*** • counting or numbers regarding living and non-living things ***Topic: Movement of Matter*** • counting or numbers regarding the movement of matter ***Topic: Movement of Matter and Energy*** • counting or numbers regarding the movement of matter and energy ***Topic: Plant and Animal Needs*** • counting or numbers regarding plant and animal needs	**5. Developing and using models** ***Topic: Ecological Relationships*** • models involving ecological relationships ***Topic: Living and Non-Living Things*** • models involving living and non-living things ***Topic: Movement of Matter*** • models involving the movement of matter ***Topic: Movement of Matter and Energy*** • models involving the movement of matter and energy ***Topic: Plant and Animal Needs*** • models involving plant and animal needs **6. Constructing explanations** ***Topic: Ecological Relationships*** • terminology about ecological relationships ***Topic: Living and Non-Living Things*** • terminology about living and non-living things ***Topic: Movement of Matter*** • terminology about the movement of matter ***Topic: Movement of Matter and Energy*** • terminology about the movement of matter and energy ***Topic: Plant and Animal Needs*** • terminology about plant and animal needs

ACCESS SKILLS to
Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)			**7. Engaging in argument from evidence** ***Topic: Ecological Relationships*** • facts about ecological relationships ***Topic: Living and Non-Living Things*** • facts about living and non-living things ***Topic: Movement of Matter*** • facts about the movement of matter ***Topic: Movement of Matter and Energy*** • facts about the movement of matter and energy ***Topic: Plant and Animal Needs*** • facts about plant and animal needs **8. Obtaining, evaluating, and communicating information** ***Topic: Ecological Relationships*** • sharing information about ecological relationships ***Topic: Living and Non-Living Things*** • sharing information about living and non-living things ***Topic: Movement of Matter*** • sharing information about the movement of matter ***Topic: Movement of Matter and Energy*** • sharing information about the movement of matter and energy ***Topic: Plant and Animal Needs*** • sharing information about plant and animal needs

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** ***Topic: Traits*** • questions about traits **2. Planning and carrying out investigations** ***Topic: Traits*** • investigations regarding traits	**3. Analyzing and interpreting data** ***Topic: Traits*** • data about traits **4. Using mathematics and computational thinking** ***Topic: Traits*** • counting or numbers regarding traits	**5. Developing and using models** ***Topic: Traits*** • models involving traits **6. Constructing explanations** ***Topic: Traits*** • terminology about traits **7. Engaging in argument from evidence** ***Topic: Traits*** • facts about traits **8. Obtaining, evaluating, and communicating information** ***Topic: Traits*** • sharing information about traits

ACCESS SKILLS to
Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ***Topic: Adaptations*** • questions about adaptations ***Topic: Common Ancestry*** • questions about common ancestry ***Topic: Environment/Habitat*** • questions about environment/habitat ***Topic: Evolution*** • questions about evolution ***Topic: Fossils and Past Environments*** • questions about fossils and past environments ***Topic: Natural and Artificial Selection*** • questions about natural and artificial selection **2. Planning and carrying out investigations** ***Topic: Adaptations*** • investigations regarding adaptations ***Topic: Common Ancestry*** • investigations regarding common ancestry ***Topic: Environment/Habitat*** • investigations regarding environment/habitat ***Topic: Evolution*** • investigations regarding evolution ***Topic: Fossils and Past Environments*** • investigations regarding fossils and past environments ***Topic: Natural and Artificial Selection*** • investigations regarding natural and artificial selection	**3. Analyzing and interpreting data** ***Topic: Adaptations*** • data about adaptations ***Topic: Common Ancestry*** • data about common ancestry ***Topic: Environment/Habitat*** • data about environment/habitat ***Topic: Evolution*** • data about evolution ***Topic: Fossils and Past Environments*** • data about fossils and past environments ***Topic: Natural and Artificial Selection*** • data about natural and artificial selection **4. Using mathematics and computational thinking** ***Topic: Adaptations*** • counting or numbers regarding adaptations ***Topic: Common Ancestry*** • counting or numbers regarding common ancestry ***Topic: Environment/Habitat*** • counting or numbers regarding environment/habitat ***Topic: Evolution*** • counting or numbers regarding evolution ***Topic: Fossils and Past Environments*** • counting or numbers regarding fossils and past environments ***Topic: Natural and Artificial Selection*** • counting or numbers regarding natural and artificial selection	**5. Developing and using models** ***Topic: Adaptations*** • models involving adaptations ***Topic: Common Ancestry*** • models involving common ancestry ***Topic: Environment/Habitat*** • models involving environment/habitat ***Topic: Evolution*** • models involving evolution ***Topic: Fossils and Past Environments*** • models involving fossils and past environments ***Topic: Natural and Artificial Selection*** • models involving natural and artificial selection **6. Constructing explanations** ***Topic: Adaptations*** • terminology about adaptations ***Topic: Common Ancestry*** • terminology about common ancestry ***Topic: Environment/Habitat*** • terminology about environment/habitat ***Topic: Evolution*** • terminology about evolution ***Topic: Fossils and Past Environments*** • terminology about fossils and past environments ***Topic: Natural and Artificial Selection*** • terminology about natural and artificial selection

ACCESS SKILLS to
Life Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**7. Engaging in argument from evidence** ***Topic: Adaptations*** • facts about adaptations ***Topic: Common Ancestry*** • facts about common ancestry ***Topic: Environment/Habitat*** • facts about environment/habitat ***Topic: Evolution*** • facts about evolution ***Topic: Fossils and Past Environments*** • facts about fossils and past environments ***Topic: Natural and Artificial Selection*** • facts about natural and artificial selection **8. Obtaining, evaluating, and communicating information** ***Topic: Adaptations*** • sharing information about adaptations ***Topic: Common Ancestry*** • sharing information about common ancestry ***Topic: Environment/Habitat*** • sharing information about environment/habitat ***Topic: Evolution*** • sharing information about evolution ***Topic: Fossils and Past Environments*** • sharing information about fossils and past environments ***Topic: Natural and Artificial Selection*** • sharing information about natural and artificial selection

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** ***Topic: Five Senses*** • Identify questions that can be answered by an investigation about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • Record relevant questions about how animals and plants grow and change over time (life cycle) based on observations ***Topic: Plant and Animal Structures*** • Record relevant questions about body parts of animals based on observations • Record relevant questions about parts of plants based on observations	**3. Analyzing and interpreting data** ***Topic: Five Senses*** • Group information/data that show how the five senses correspond to the body parts (e.g. ears sense sound, eyes sense light, etc.) ***Topic: Life Cycles, Growth, and Reproduction*** • 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, table, or pictures to show how plants grow and change over time • Display data using a simple graph, table, or pictures to show how animals grow and change over time ***Topic: Plant and Animal Structures*** • Group information/data that show how the external parts of plants or animals support growth and survival	**5. Developing and using models** ***Topic: Five Senses*** • 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.) ***Topic: Life Cycles, Growth, and Reproduction*** • 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 ***Topic: Plant and Animal Structures*** • 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)

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** ***Topic: Five Senses*** • 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) ***Topic: Life Cycles, Growth, and Reproduction*** • Record observations (e.g., first-hand experiences, media) to collect data related to how plants grow and change over time • Record observations (e.g., firs-hand experiences, media) to collect data related to what plants need to grow and survive ***Topic: Plant and Animal Structures*** • 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** ***Topic: Five Senses*** • Use counting and numbers to show data about the five senses ***Topic: Life Cycles, Growth, and Reproduction*** • 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 ***Topic: Plant and Animal Structures*** • Use counting and numbers to show data about the external parts of plants that support growth and survival • Use counting and numbers to show data about the external body parts of animals that support growth and survival	**6. Constructing explanations** ***Topic: Five Senses*** • Describe or list how animals use their senses to gather information (e.g., sight, sound, smell, taste, touch) ***Topic: Life Cycles, Growth, and Reproduction*** • Describe or list how plants grow and change over time • Describe or list how animals grow and change over time ***Topic: Plant and Animal Structures*** • Identify observations that match descriptions about the functions of external parts of plants (e.g., roots, stems, leaves, and flowers) • Identify observations that match descriptions about the functions of external parts of animals (e.g., wings, antennae, beaks, legs, fins)

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.)			**7. Engaging in argument from evidence** ***Topic: Five Senses*** • Use scientific evidence in support of an argument about animals use their senses to gather information (e.g., sight, sound, smell, taste, touch) ***Topic: Life Cycles, Growth, and Reproduction*** • Use scientific evidence in support of an argument about how plants and animals grow and change over time ***Topic: Plant and Animal Structures*** • Use scientific evidence in support of an argument about the functions of external parts of plants (e.g., roots, stems, leaves, and flowers) • Use scientific evidence in support of an argument about the functions of external parts of animals (e.g., wings, antennae, beaks, legs, fins)

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** ***Topic: Five Senses*** • Communicate scientific information or ideas about the use of the five senses to understand the world ***Topic: Life Cycles, Growth, and Reproduction*** • Recall and present information from observations, text, or media source about how plants grow and change over time ***Topic: Plant and Animal Structures*** • 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 functions of external parts of animals (e.g., wings, antennae, beaks, legs, fins)

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	**1. Asking questions/defining problems** ***Topic: Living and Non-Living Things*** • Record relevant questions about living and nonliving things based on observations ***Topic: Plant and Animal Needs*** • 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 **2. Planning and carrying out investigations** ***Topic: Living and Non-Living Things*** • Use pictures and/or drawings to collect observations related to living vs. non-living things ***Topic: Plant and Animal Needs*** • Record observations (e.g., first hand experiences, media) to collect data related to the basic needs of an animal or plant	**3. Analyzing and interpreting data** ***Topic: Living and Non-Living Things*** • Group information/data about the specific characteristics that differentiate living from non-living things • Display data using a simple graph, table, or pictures to show living and non-living things ***Topic: Plant and Animal Needs*** • Group information/data about the needs of plants and animals to identify patterns **4. Using mathematics and computational thinking** ***Topic: Living and Non-Living Things*** • Use counting and numbers to show data about living and non-living things within the local environment ***Topic: Plant and Animal Needs*** • 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** ***Topic: Living and Non-Living Things*** • Illustrate, construct, and/or label a model to show/explain specific characteristics that differentiate living from non-living things ***Topic: Plant and Animal Needs*** • 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) **6. Constructing explanations** ***Topic: Living and Non-Living Things*** • Identify observations that match descriptions about non-living and living things ***Topic: Plant and Animal Needs*** • 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)

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystems: Interactions, Energy, and Dynamics (cont.)			**7. Engaging in argument from evidence** ***Topic: Living and Non-Living Things*** • Use scientific evidence to support a claim regarding the characteristics of living things that distinguish them from non-living things ***Topic: Plant and Animal Needs*** • 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 how animals meet their needs (water, food, air, favorable temperatures, and shelter) in a local environment **8. Obtaining, evaluating, and communicating information** ***Topic: Living and Non-Living Things*** • Research, record evidence, and/or present information from various texts to explain specific characteristics that differentiate living from non-living things ***Topic: Plant and Animal Needs*** • 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)

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	**1. Asking questions/defining problems** ***Topic: Traits*** • 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 **2. Planning and carrying out investigations** ***Topic: Traits*** • 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	**3. Analyzing and interpreting data** ***Topic: Traits*** • 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 **4. Using mathematics and computational thinking** ***Topic: Traits*** • Use counting and numbers to show data about different types of plants • Use counting and numbers to show data about different types of animals	**5. Developing and using models** ***Topic: Traits*** • 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** ***Topic: Traits*** • 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 **7. Engaging in argument from evidence** ***Topic: Traits*** • 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

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** ***Topic: Traits*** • 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 • 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
Biological Evolution: Unity and Diversity	**1. Asking questions/defining problems** ***Topic: Environment/Habitat*** • 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) • 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** ***Topic: Environment/Habitat*** • Record observations (e.g., first hand 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., first hand 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** ***Topic: Environment/Habitat*** • Group information/data about animals by habitat to identify patterns • Group information/data about plants by habitat to identify patterns • Display data using a simple graph, table, or pictures to show the kinds of living things in different environments (e.g., rainforest, desert, grassland) • Display data using a simple graph, table, or pictures to show living things in a local habitat (e.g., school yard) **4. Using mathematics and computational thinking** ***Topic: Environment/Habitat*** • Use counting and numbers to show data about living things in a local habitat	**5. Developing and using models** ***Topic: Environment/Habitat*** • 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 the different kinds of living things in different habitats **6. Constructing explanations** ***Topic: Environment/Habitat*** • 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** ***Topic: Environment/Habitat*** • Use scientific evidence in support of an argument about different plants and animals live in different habitats

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Environment/Habitat*** • 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)

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 3

Core Idea	Learning Standard ID	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.
Heredity: Inheritance and Variation of Traits	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 3

Core Idea	Learning Standard ID	Learning Standards as written
Biological Evolution: Unity and Diversity	**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.
Biological Evolution: Unity and Diversity	**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.
Biological Evolution: Unity and Diversity	**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.
Biological Evolution: Unity and Diversity	**3-LS4-5(MA)**	Provide evidence to support a claim that the survival of a population is dependent upon reproduction.

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 4

Core Idea	Learning Standard ID	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.

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 5

Core Idea	Learning Standard ID	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: Interactions, 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.
Ecosystems: Interactions, Energy, and Dynamics	**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** ***Topic: Life Cycles, Growth, and Reproduction*** • Use observations and/or data to ask relevant questions about the life cycles of animals and plants (birth, growth, reproduction, and death) ***Topic: Plant and Animal Structures*** • Use observations and/or data to ask relevant questions about plant structures • Use observations and/or data to ask relevant questions about animal structures • 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	**3. Analyzing and interpreting data** ***Topic: Life Cycles, Growth, and Reproduction*** • Compare predictions to the data and/or observations from an investigation about the effect of sunlight on the growth of plants • Display data using a simple graph to show the effect of water and/or sunlight on the growth of plants ***Topic: Plant and Animal Structures*** • Draw conclusions based on evidence (e.g., from an investigation) related to structures of plants that promote survival, growth, and reproduction (e.g., leaves, roots, stem, bark, branches, flowers, fruits, seeds) • Draw conclusions based on evidence (e.g., from an investigation) related to structures of animals that promote survival, growth, and reproduction (e.g., wings, antennae, beaks, legs, fins) **4. Using mathematics and computational thinking** ***Topic: Life Cycles, Growth, and Reproduction*** • Use counting and numbers to show data about the effect of water and/or sunlight on the growth of plants ***Topic: Plant and Animal Structures*** • Use counting and numbers to show data about the structures of animals that promote survival, growth, and reproduction (e.g., limbs, eyes, ears)	**5. Developing and using models** ***Topic: Life Cycles, 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) ***Topic: Plant and Animal Structures*** • Illustrate or develop a model to show/explain the functions of external plant structures • Illustrate or develop a model to show/explain the functions of external animal structures **6. Constructing explanations** ***Topic: Life Cycles, Growth, and Reproduction*** • 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) ***Topic: Plant and Animal Structures*** • 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)

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** ***Topic: Life Cycles, Growth, and Reproduction*** • 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 ***Topic: Plant and Animal Structures*** • Record observations (e.g., first hand 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., first hand experiences, media) to collect data related to the structures of animals that promote survival, growth, and reproduction (e.g., legs, wings, fins, feathers)		**7. Engaging in argument from evidence** ***Topic: Life Cycles, Growth, and Reproduction*** • 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) ***Topic: Plant and Animal Structures*** • Use scientific evidence to support a claim that specific plant structures support their survival and growth (e.g., leaves, thorns) • Use scientific evidence to support a claim that specific animal structures support their survival and growth (e.g., wings, fins) **8. Obtaining, evaluating, and communicating information** ***Topic: Life Cycles, Growth, and Reproduction*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about plant and animal life cycles (birth, growth, reproduction, and death) ***Topic: Plant and Animal Structures*** • 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)

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** ***Topic: Movement of Matter*** • 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) • 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** ***Topic: Movement of Matter*** • 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) • Record observations (e.g., first hand experiences, media) to collect data related to organisms in an ecosystem as producers, consumers, and/or decomposers	**3. Analyzing and interpreting data** ***Topic: Movement of Matter*** • Use data and/or observations to identify relationships between producers, consumers, and/or decomposers • Draw conclusions based on evidence (e.g., from an investigation) about decomposition in the environment **4. Using mathematics and computational thinking** ***Topic: Movement of Matter*** • Organize the qualitative and quantitative information about the relationship between producers, consumers, and decomposers in an ecosystem (e.g., food webs, graphs) • Organize the qualitative and quantitative information about decomposition in the environment	**5. Developing and using models** ***Topic: Movement of Matter*** • 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 the role of decomposers in recycling matter from waste and dead organisms back into the ecosystem **6. Constructing explanations** ***Topic: Movement of Matter*** • Use tools and/or materials to build a composter that allows materials to decompose • Describe the relationship between producers, consumers, and decomposers • Describe the characteristics of producers, consumers, and decomposers **7. Engaging in argument from evidence** ***Topic: Movement of Matter*** • Use scientific evidence to support a claim about the conditions necessary for rapid decomposition within a ecosystem **8. Obtaining, evaluating, and communicating information** ***Topic: Movement of Matter*** • 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

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	**1. Asking questions/defining problems** ***Topic: Traits*** • 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 **2. Planning and carrying out investigations** ***Topic: Traits*** • 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., first hand experiences, media) to collect data related to inherited traits of plants • Record observations (e.g., first hand experiences, media) to collect data related to inherited traits of animals	**3. Analyzing and interpreting data** ***Topic: Traits*** • 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 **4. Using mathematics and computational thinking** ***Topic: Traits*** • 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** ***Topic: Traits*** • 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 **6. Constructing explanations** ***Topic: Traits*** • Describe how inherited traits (e.g., fur color, size of flowers) of a plant and/or animal offspring are characteristics of each parent • Describe variations in the traits and characteristics of offspring within the same species **7. Engaging in argument from evidence** ***Topic: Traits*** • Use scientific evidence to support a claim that inherited traits of a plant and/or animal offspring are characteristics of each parent **8. Obtaining, evaluating, and communicating information** ***Topic: Traits*** • 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)

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	**1. Asking questions/defining problems** ***Topic: Adaptations*** • 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) ***Topic: Environment/Habitat*** • 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 ***Topic: Fossils and Past Environments*** • Use observations and/or data to ask relevant questions about fossils	**3. Analyzing and interpreting data** ***Topic: Adaptations*** • 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) ***Topic: Environment/Habitat*** • 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) ***Topic: Fossils and Past Environments*** • 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) • Draw conclusions based on evidence (e.g., from an investigation) about plants and/or animals that lived long ago, but no longer exist	**5. Developing and using models** ***Topic: Adaptations*** • 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 ***Topic: Environment/Habitat*** • Illustrate or develop a model to show/explain how the environment of a plant or animal impacts its ability to survive ***Topic: Fossils and Past Environments*** • Distinguish between a model of a fossil and the actual fossil **6. Constructing explanations** ***Topic: Adaptations*** • Describe the survival of a plant or animal population ***Topic: Environment/Habitat*** • Describe how the environment of a plant impacts its ability to survive • Describe how the environment of an animal impacts its ability to survive. ***Topic: Fossils and Past Environments*** • Describe similarities and differences between fossils and present-day organisms

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** ***Topic: Adaptations*** • Record observations (e.g., first hand 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., first hand 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) ***Topic: Environment/Habitat*** • Record observations (e.g., first hand 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) ***Topic: Fossils and Past Environments*** • Record observations (e.g., first hand experiences, media) to collect data related to fossils (physical and observable features)	**4. Using mathematics and computational thinking** ***Topic: Adaptations*** • 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) • 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) ***Topic: Environment/Habitat*** • Use counting and numbers to show data about fossils and past environments (e.g., number of wooly mammoths found in an area ***Topic: Fossils and Past Environments*** • Organize the qualitative and quantitative information about fossils and past environments	**7. Engaging in argument from evidence** ***Topic: Adaptations*** • Use scientific evidence to support a claim that plants or animals have features that enable them to survive in their habitat (e.g., thick fur in a cold climate, waxy leaves to repel water in wet climates) ***Topic: Environment/Habitat*** • Use scientific evidence to support a claim that changes in the environment impact the survival of plants or animals ***Topic: Fossils and Past Environments*** • 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

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Biological Evolution: Unity and Diversity (cont.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Adaptations*** • Research and present information about features of animals that help them survive (e.g., sense of smell, thick fur, large ears) • Research and present information about features of plants that help them survive (e.g., different shaped leaves, spikes) ***Topic: Environment/Habitat*** • 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 • 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 ***Topic: Fossils and Past Environments*** • 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)

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 6

Core Idea	Learning Standard ID	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.
From Molecules to Organisms: Structures and Processes	**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).
From Molecules to Organisms: Structures and Processes	**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 Standard ID	Learning Standards as written
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.
Biological Evolution: Unity and Diversity	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 7

Core Idea	Learning Standard ID	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: Interactions, 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.
Ecosystems: Interactions, Energy, and Dynamics	**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.
Ecosystems: Interactions, Energy, and Dynamics	**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 Standard ID	Learning Standards as written
Ecosystems: Interactions, Energy, and Dynamics	**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.
Ecosystems: Interactions, Energy, and Dynamics	**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.
Ecosystems: Interactions, Energy, and Dynamics	**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 Standard ID	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.
From Molecules to Organisms: Structures and Processes	**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.
Heredity: Inheritance and Variation of Traits	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Life Science

Grade Level: Grade 8

Core Idea	Learning Standard ID	Learning Standards as written
Heredity: Inheritance and Variation of Traits	**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	**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.
Biological Evolution: Unity and Diversity	**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** ***Topic: Body Systems*** • 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) ***Topic: Cells and Cell Structures*** • Generate scientific questions about plant and/or animal cells based on research and/or observations ***Topic: Environmental Impacts on Growth and Survival*** • 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)	**3. Analyzing and interpreting data** ***Topic: Body Systems*** • Compare and contrast data showing how food molecules are broken down and rearranged to support cell growth and/or release of energy ***Topic: Cells and Cell Structures*** • Compare and contrast data showing the functions of plant and animal cells ***Topic: Environmental Impacts on Growth and Survival*** • 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 the environmental factors that affect animal growth **4. Using mathematics and computational thinking** ***Topic: Body Systems*** • Organize simple data sets to reveal patterns about food molecules to include carbohydrates, fats, and proteins (e.g., compare food labels) ***Topic: Cells and Cell Structures*** • Identify the qualitative and quantitative information about the functions of plant and animal cells ***Topic: Environmental Impacts on Growth and Survival*** • Organize simple data sets to reveal patterns about environmental factors that impact plant or animal growth	**5. Developing and using models** ***Topic: Body Systems*** • Develop, revise, and/or use a model to show/explain a major body system (e.g., circulatory, digestive, respiratory, excretory, muscular/skeletal, nervous) ***Topic: Cells and Cell Structures*** • Develop, revise, and/or use a model to show/explain the functions of plant and/or animal cells ***Topic: Environmental Impacts on Growth and Survival*** • Develop, revise, and/or use a model to show/explain how environmental factors impact organism growth (e.g., plants and animals) **6. Constructing explanations** ***Topic: Body Systems*** • Explain the relationships between the major body systems ***Topic: Cells and Cell Structures*** • Explain the functions of cell parts ***Topic: Environmental Impacts on Growth and Survival*** • Explain the relationship between environmental factors and organism growth (e.g., plants or animals)

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** ***Topic: Body Systems*** • 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) ***Topic: Cells and Cell Structures*** • 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) ***Topic: Environmental Impacts on Growth and Survival*** • 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 a simulation about the change in environmental factors that affect organism growth (e.g., food, shelter, water, weather) to produce data/observations to serve as evidence		**7. Engaging in argument from evidence** ***Topic: Body Systems*** • 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 ***Topic: Cells and Cell Structures*** • Use scientific evidence and observations to construct an argument that all organisms are made up of cells ***Topic: Environmental Impacts on Growth and Survival*** • Use scientific evidence and observations to construct an argument for how environmental factors influence organism growth (e.g., plants or animals) **8. Obtaining, evaluating, and communicating information** ***Topic: Body Systems*** • Research and record information explaining how the body's systems interact ***Topic: Cells and Cell Structures*** • 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 ***Topic: Environmental Impacts on Growth and Survival*** • Combine scientific information from multiple sources to explain how environmental factors influence organism growth (e.g., plants or animals)

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** ***Topic: Ecological Relationships*** • 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 how matter and energy is transferred through an ecosystem based on research and/or observations (e.g., food webs) ***Topic: Movement of Matter and Energy*** • Generate scientific questions about photosynthesis based on research and/or observations **2. Planning and carrying out investigations** ***Topic: Ecological Relationships*** • 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 ***Topic: Movement of Matter and Energy*** • Plan and/or conduct an investigation about cellular respiration to produce data/observations to serve as evidence about photosynthesis	**3. Analyzing and interpreting data** ***Topic: Ecological Relationships*** • Use observations and/or data from an investigation to determine different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem • Compare and contrast data showing the biodiversity of different ecosystems ***Topic: Movement of Matter and Energy*** • Analyze and interpret data to make sense of photosynthesis • Analyze and interpret data to make sense of matter and energy **4. Using mathematics and computational thinking** ***Topic: Ecological Relationships*** • 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 ***Topic: Movement of Matter and Energy*** • Evaluate if qualitative or quantitative data is best to collect as evidence in an investigation about photosynthesis in an experiment	**5. Developing and using models** ***Topic: Ecological Relationships*** • 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 the different relationships (e.g., competitive, predatory, mutual beneficial, parasitic) in an ecosystem ***Topic: Movement of Matter and Energy*** • Develop, revise, and/or use a model to show/explain photosynthesis **6. Constructing explanations** ***Topic: Ecological Relationships*** • 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 ***Topic: Movement of Matter and Energy*** • Describe how energy from the sun is converted by plants into food (photosynthesis)

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			**7. Engaging in argument from evidence** ***Topic: Ecological Relationships*** • Use scientific evidence and observations to construct an argument about how a plant or animal helps or harms other organisms in its ecosystem ***Topic: Movement of Matter and Energy*** Use scientific evidence and observations to construct an argument about how energy from the Sun is converted by plants into food (photosynthesis) by citing relevant evidence **8. Obtaining, evaluating, and communicating information** ***Topic: Ecological Relationships*** • 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) ***Topic: Movement of Matter and Energy*** • Combine scientific information from multiple sources to explain the transfer of energy and matter in an ecosystem (e.g., photosynthesis, cellular respiration, and decomposition)

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** ***Topic: Traits*** • Generate scientific questions about dominant and recessive inherited traits based on research and/or observations **2. Planning and carrying out investigations** ***Topic: Traits*** • 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	**3. Analyzing and interpreting data** ***Topic: Traits*** • 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 inheriting a particular trait using a Punnett square **4. Using mathematics and computational thinking** ***Topic: 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** ***Topic: Traits*** • 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) **6. Constructing explanations** ***Topic: Traits*** • Draw conclusions based on multiple pieces of evidence about the advantages and disadvantages of sexual and asexual reproduction **7. Engaging in argument from evidence** ***Topic: Traits*** • 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) • 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** ***Topic: Traits*** • 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-handed-ness, freckles, shape of ears)

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	**1. Asking questions/defining problems** ***Topic: Common Ancestry*** • Generate scientific questions about the evolutionary relationships between fossil organisms and modern organisms based on research and/or observations ***Topic: Natural and Artificial Selection*** • Ask questions how artificial selection is used to create a genetic modification in plants and/or animals (e.g., seedless watermelon, dogs) **2. Planning and carrying out investigations** ***Topic: Common Ancestry*** • Record observations and/or measurements to produce data to serve as evidence for investigations about evolutionary relationships between fossil organisms and modern organisms ***Topic: Natural and Artificial Selection*** • 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	**3. Analyzing and interpreting data** ***Topic: Common Ancestry*** • 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 ***Topic: Natural and Artificial Selection*** • Analyze and interpret data to make sense of the process of natural selection in a plant or animal population • Compare and contrast data showing different technologies used for artificial selection (e.g., genetic modification, animal husbandry, gene therapy) **4. Using mathematics and computational thinking** ***Topic: Common Ancestry*** • Organize simple data sets to reveal patterns about evolutionary relationships between fossil organisms and modern organisms ***Topic: Natural and Artificial Selection*** • 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	**5. Developing and using models** ***Topic: Common Ancestry*** • Develop, revise, and/or use a model to show/explain the similarity in the limb structures of mammals ***Topic: Natural and Artificial Selection*** • Develop, revise, and/or use a model to show/explain the process of natural selection in a population **6. Constructing explanations** ***Topic: Common Ancestry*** • Describe how modern organisms are similar to their extinct ancestors (e.g., woolly mammoth and elephant) ***Topic: Natural and Artificial Selection*** • 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 **7. Engaging in argument from evidence** ***Topic: Common Ancestry*** • Use scientific evidence and observations to construct an argument about the common ancestry of certain plants and/or animals ***Topic: Natural and Artificial Selection*** • Use scientific evidence and observations to construct an argument about how natural selection takes place over many generations

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** ***Topic: Common Ancestry*** • 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) ***Topic: Natural and Artificial Selection*** • Research, record evidence, and/or present information on the process of natural selection • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about differences between natural selection and artificial selection

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 98–99	Pages 105–106	Pages 113–114	Pages 124–125
Motion and Stability: Forces and Interactions	Pages 100–101	Page 107	Pages 115–116	Page 126
Energy	Pages 102–103	Page 108	Page 117	Pages 127–128
Waves and Their Applications in Technologies for Information Transfer	Page 104	Page 109	Page 118	Page 129

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Pre-Kindergarten

Core Idea	Learning Standard ID	Learning Standards as written
Matter and Its Interactions	**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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**PreK-PS1-3(MA)**	Differentiate between the properties of an object and those of the material of which it is made.
Matter and Its Interactions	**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 Interactions	**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.
Motion and Stability: Forces and Interactions	**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.
Waves and Their Applications in Tech-nologies for Information Transfer	**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 Standard ID	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 Interactions	**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.
Energy	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 1

Core Idea	Learning Standard ID	Learning Standards as written
Waves and Their Applications in Technologies 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.
Waves and Their Applications in Technologies for Information Transfer	**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.
Waves and Their Applications in Technologies for Information Transfer	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 2

Core Idea	Learning Standard ID	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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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

Instructions for creating access skills for Science and Technology/Engineering:

Select the access skill from **Step 1** and then choose and merge with content from the provided lists in **Step 2** for selected STE Core Idea.
Sample access skill for Core Idea of Matter and Its Interactions:

- *Move materials in an activity related to models involving chemical and physical changes*

Step 1: Select access skill student is addressing:

Access Skill:
○ Activate a device (within a specified amount of time) to participate in an activity related to…
○ Choose from an array of errorless choices (within a specified amount of time) to participate in an activity related to…
○ Grasp, release, or give materials in an activity related to…
○ Explore materials (tactilely) in an activity related to…
○ Track materials in an activity related to…
○ Functionally use materials in an activity related to…
○ Gain attention within a specified time block(s) to explore materials in an activity related to…
○ Imitate action in an activity related to…
○ Initiate cause and effect response in an activity related to…
○ Locate objects partially hidden or out of sight in an activity related to…
○ Make a request to explore materials in an activity related to…
○ Match object to object, or picture to picture of materials in an activity related to…
○ Move materials in an activity related to…
○ Orient or manipulate materials or a model in an activity related to…
○ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials in an activity related to…
○ Turn on/off technology within a specified amount of time in an activity related to…

ACCESS SKILLS to
Physical Science Standards

Step 2: Choose the Core Idea content/topic in which data will be collected on the skill:

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions	**1. Asking questions/defining problems** ***Topic: Chemical and Physical Changes*** • questions about chemical and physical changes ***Topic: Density*** • questions about density ***Topic: Properties of Matter (solids, liquids, and gases)*** • questions about properties of matter (solids, liquids, and gases) **2. Planning and carrying out investigations** ***Topic: Chemical and Physical Changes*** • investigations regarding chemical and physical changes ***Topic: Density*** • investigations regarding density ***Topic: Properties of Matter (solids, liquids, and gases)*** • investigations regarding properties of matter (solids, liquids, and gases)	**3. Analyzing and interpreting data** ***Topic: Chemical and Physical Changes*** • data about chemical and physical changes ***Topic: Density*** • data about density ***Topic: Properties of Matter (solids, liquids, and gases)*** • data about properties of matter (solids, liquids, and gases) **4. Using mathematics and computational thinking** ***Topic: Chemical and Physical Changes*** • counting or numbers regarding chemical and physical changes ***Topic: Density*** • counting or numbers regarding density ***Topic: Properties of Matter (solids, liquids, and gases)*** • counting or numbers regarding properties of matter (solids, liquids, and gases)	**5. Developing and using models** ***Topic: Chemical and Physical Changes*** • models involving chemical and physical changes ***Topic: Density*** • models involving density ***Topic: Properties of Matter (solids, liquids, and gases)*** • models involving properties of matter (solids, liquids, and gases) **6. Constructing explanations** ***Topic: Chemical and Physical Changes*** • terminology about chemical and physical changes ***Topic: Density*** • terminology about density ***Topic: Properties of Matter (solids, liquids, and gases)*** • terminology about properties of matter (solids, liquids, and gases)

ACCESS SKILLS to
Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)			**7. Engaging in argument from evidence** ***Topic: Chemical and Physical Changes*** • facts about chemical and physical changes ***Topic: Density*** • facts about density ***Topic: Properties of Matter (solids, liquids, and gases)*** • facts about properties of matter (solids, liquids, and gases) **8. Obtaining, evaluating, and communicating information** ***Topic: Chemical and Physical Changes*** • sharing information about chemical and physical changes ***Topic: Density*** • sharing information about density ***Topic: Properties of Matter (solids, liquids, and gases)*** • sharing information about properties of matter (solids, liquids, and gases)

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** ***Topic: Circuits*** • questions about circuits ***Topic: Forces*** • questions about forces ***Topic: Magnets*** • questions about magnets ***Topic: Pushes and Pulls*** • questions about pushes and pulls **2. Planning and carrying out investigations** ***Topic: Circuits*** • investigations regarding circuits ***Topic: Forces*** • investigations regarding forces ***Topic: Magnets*** • investigations regarding magnets ***Topic: Pushes and Pulls*** • investigations regarding pushes and pulls	**3. Analyzing and interpreting data** ***Topic: Circuits*** • data about circuits ***Topic: Forces*** • data about forces ***Topic: Magnets*** • data about magnets ***Topic: Pushes and Pulls*** • data about pushes and pulls **4. Using mathematics and computational thinking** ***Topic: Circuits*** • counting or numbers regarding circuits ***Topic: Forces*** • counting or numbers regarding forces ***Topic: Magnets*** • counting or numbers regarding magnets ***Topic: Pushes and Pulls*** • counting or numbers regarding pushes and pulls	**5. Developing and using models** ***Topic: Circuits*** • models involving circuits ***Topic: Forces*** • models involving forces ***Topic: Magnets*** • models involving magnets ***Topic: Pushes and Pulls*** • models involving pushes and pulls **6. Constructing explanations** ***Topic: Circuits*** • terminology about circuits ***Topic: Forces*** • terminology about forces ***Topic: Magnets*** • terminology about magnets ***Topic: Pushes and Pulls*** • terminology about pushes and pulls

ACCESS SKILLS to
Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Motion and Stability: Forces and Interactions (cont.)			**7. Engaging in argument from evidence** ***Topic: Circuits*** • facts about circuits ***Topic: Forces*** • facts about forces ***Topic: Magnets*** • facts about magnets ***Topic: Pushes and Pulls*** • facts about pushes and pulls **8. Obtaining, evaluating, and communicating information** ***Topic: Circuits*** • sharing information about circuits ***Topic: Forces*** • sharing information about forces ***Topic: Magnets*** • sharing information about magnets ***Topic: Pushes and Pulls*** • sharing information about pushes and pulls

ACCESS SKILLS to
Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy	**1. Asking questions/defining problems** ***Topic: Energy Transfer*** • questions about energy transfer ***Topic: Kinetic and Potential Energy*** • questions about kinetic and potential energy ***Topic: The Sun's Warmth*** • questions about the Sun's warmth ***Topic: Thermal Energy Transfer*** • questions about thermal energy transfer **2. Planning and carrying out investigations** ***Topic: Energy Transfer*** • investigations regarding energy transfer ***Topic: Kinetic and Potential Energy*** • investigations regarding kinetic and potential energy ***Topic: The Sun's Warmth*** • investigations regarding the Sun's warmth ***Topic: Thermal Energy Transfer*** • investigations regarding thermal energy transfer	**3. Analyzing and interpreting data** ***Topic: Energy Transfer*** • data about energy transfer ***Topic: Kinetic and Potential Energy*** • data about kinetic and potential energy ***Topic: The Sun's Warmth*** • data about the Sun's warmth ***Topic: Thermal Energy Transfer*** • data about thermal energy transfer **4. Using mathematics and computational thinking** ***Topic: Energy Transfer*** • counting or numbers regarding energy transfer ***Topic: Kinetic and Potential Energy*** • counting or numbers regarding kinetic and potential energy ***Topic: The Sun's Warmth*** • counting or numbers regarding the Sun's warmth ***Topic: Thermal Energy Transfer*** • counting or numbers regarding thermal energy transfer	**5. Developing and using models** ***Topic: Energy Transfer*** • models involving energy transfer ***Topic: Kinetic and Potential Energy*** • models involving kinetic and potential energy ***Topic: The Sun's Warmth*** • models involving the Sun's warmth ***Topic: Thermal Energy Transfer*** • models involving thermal energy transfer **6. Constructing explanations** ***Topic: Energy Transfer*** • terminology about energy transfer ***Topic: Kinetic and Potential Energy*** • terminology about kinetic and potential energy ***Topic: The Sun's Warmth*** • terminology about the Sun's warmth ***Topic: Thermal Energy Transfer*** • terminology about thermal energy transfer

ACCESS SKILLS to
Physical Science Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)			**7. Engaging in argument from evidence** ***Topic: Energy Transfer*** • facts about energy transfer ***Topic: Kinetic and Potential Energy*** • facts about kinetic and potential energy ***Topic: The Sun's Warmth*** • facts about the Sun's warmth ***Topic: Thermal Energy Transfer*** • facts about thermal energy transfer **8. Obtaining, evaluating, and communicating information** ***Topic: Energy Transfer*** • sharing information about energy transfer ***Topic: Kinetic and Potential Energy*** • sharing information about kinetic and potential energy ***Topic: The Sun's Warmth*** • sharing information about the Sun's warmth ***Topic: Thermal Energy Transfer*** • sharing information about thermal energy transfer

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	**1. Asking questions/defining problems** ***Topic: Light and Sound*** • questions about light and sound **2. Planning and carrying out investigations** ***Topic: Light and Sound*** • investigations regarding light and sound	**3. Analyzing and interpreting data** ***Topic: Light and Sound*** • data about light and sound **4. Using mathematics and computational thinking** ***Topic: Light and Sound*** • counting or numbers regarding light and sound	**5. Developing and using models** ***Topic: Light and Sound*** • models involving light and sound **6. Constructing explanations** ***Topic: Light and Sound*** • terminology about light and sound **7. Engaging in argument from evidence** ***Topic: Light and Sound*** • facts about light and sound **8. Obtaining, evaluating, and communicating information** ***Topic: Light and Sound*** • sharing information about light and sound

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	**1. Asking questions/defining problems** ***Topic: Properties of Matter (solids, liquids, and gases)*** • Record relevant questions about the characteristics of solids and liquids 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) • Identify questions that can be answered by an investigation, about the characteristics of solids and liquids **2. Planning and carrying out investigations** ***Topic: Properties of Matter (solids, liquids, and gases)*** • 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 • 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	**3. Analyzing and interpreting data** ***Topic: Properties of Matter (solids, liquids, and gases)*** • 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 how heating/cooling causes changes to solids and liquids **4. Using mathematics and computational thinking** ***Topic: Properties of Matter (solids, liquids, and gases)*** • 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	**5. Developing and using models** ***Topic: Properties of Matter (solids, liquids, and gases)*** • 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 the differences between a liquid and a solid **6. Constructing explanations** ***Topic: Properties of Matter (solids, liquids, and gases)*** • Describe how observable properties are used to categorize solids or liquids • 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 **7. Engaging in argument from evidence** ***Topic: Properties of Matter (solids, liquids, and gases)*** • 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 how heating/cooling causes changes to solids and liquids that may or may not be able to be reversed

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** ***Topic: Properties of Matter (solids, liquids, and gases)*** • Recall and present information from observations, text, or media source about the observable properties are used to categorize solids or liquids • 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

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 Interactions	**1. Asking questions/defining problems** ***Topic: Pushes and Pulls*** • Identify questions that can be answered by an investigation about forces (pushes and pulls) that act upon an object **2. Planning and carrying out investigations** ***Topic: Pushes and Pulls*** • 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	**3. Analyzing and interpreting data** ***Topic: Pushes and Pulls*** • Compare predictions to the data and/or observations from an investigation about whether an object will move as a result of applying a force **4. Using mathematics and computational thinking** ***Topic: Pushes and Pulls*** • 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	**5. Developing and using models** ***Topic: Pushes and Pulls*** • 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 **6. Constructing explanations** ***Topic: Pushes and Pulls*** • 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 **7. Engaging in argument from evidence** ***Topic: Pushes and Pulls*** • Use scientific evidence in support of an argument about how the motion of an object changes when different forces are applied to the object **8. Obtaining, evaluating, and communicating information** ***Topic: Pushes and Pulls*** • Recall and present information from observations, text, or media source about how pushes or pulls affect the movement of an object

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

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy	**1. Asking questions/defining problems** ***Topic: The Sun's Warmth*** • Identify questions that can be answered by an investigation about why different objects feel warmer than other objects when exposed to the Sun **2. Planning and carrying out investigations** ***Topic: The Sun's Warmth*** • 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 • Record observations (e.g., firsthand experiences, media) to collect data related to the relative warmth of objects made of different materials when they are exposed to the Sun	**3. Analyzing and interpreting data** ***Topic: The Sun's Warmth*** • Display data using a simple graph, table, 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** ***Topic: The Sun's Warmth*** • Identify the qualitative and quantitative information about the relative warmth of objects made of different materials when they are exposed to the Sun	**5. Developing and using models** ***Topic: The Sun's Warmth*** • 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 **6. Constructing explanations** ***Topic: The Sun's Warmth*** • Describe how the Sun impacts the relative warmth of different objects • 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** ***Topic: The Sun's Warmth*** • 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** ***Topic: The Sun's Warmth*** • 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** ***Topic: Light and Sound*** • Record relevant questions about shadows based on observations • Identify questions that can be answered by an investigation about making sound using various materials (e.g., different volume and pitch) **2. Planning and carrying out investigations** ***Topic: Light and Sound*** • 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) • 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	**3. Analyzing and interpreting data** ***Topic: Light and Sound*** • Group information/data about the loudness of sounds produced by striking objects differently (e.g., varying degrees of strength) to identify patterns • Display data using a simple graph, table, 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** ***Topic: Light and Sound*** • 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	**5. Developing and using models** ***Topic: Light and Sound*** • 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 the parts of a sound wave to demonstrate how sound waves transmit a message across the room **6. Constructing explanations** ***Topic: Light and Sound*** • Describe how light will/will not pass through various materials • Describe how sounds are changed by manipulating a variety of objects and materials **7. Engaging in argument from evidence** ***Topic: Light and Sound*** • Use scientific evidence in support of an argument about how to change the size/shape of a shadow created by an object **8. Obtaining, evaluating, and communicating information** ***Topic: Light and Sound*** • 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 • Communicate scientific information or ideas about a device that transmits a message across the room using light or sound

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 3

Core Idea	Learning Standard ID	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.
Motion and Stability: Forces and Interactions	**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.
Motion and Stability: Forces and Interactions	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 4

Core Idea	Learning Standard ID	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.
Energy	**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.
Energy	**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.
Energy	**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.
Waves and Their Applications in Tech-nologies for Information Transfer	**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.
Waves and Their Applications in Tech-nologies for Information Transfer	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 5

Core Idea	Learning Standard ID	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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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** ***Topic: Chemical and Physical Changes*** • Use observations and/or data to ask relevant questions about phase changes (i.e., changes between solids, liquids, or gases) • Identify questions that can be answered by an investigation about physical and chemical changes • Identify questions that can be answered by an investigation about phase changes ***Topic: Properties of Matter (solids, liquids, and gases)*** • Generate scientific questions about the characteristics of specific materials (e.g., are they absorbent, reflective, transparent; do they retain heat?) **2. Planning and carrying out investigations** ***Topic: Chemical and Physical Changes*** • 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., first hand experiences, media) to collect data related to whether a substance is the result of a physical or chemical change ***Topic: Properties of Matter (solids, liquids, and gases)*** • Plan and/or follow the steps of an investigation to collect data and/or observations about solids, liquids, and gases	**3. Analyzing and interpreting data** ***Topic: Chemical and Physical Changes*** • Compare predictions to the data and/or observations from an investigation about phase changes • Draw conclusions based on evidence (e.g., from an investigation) about whether combining two substances results in a new substance or a mixture ***Topic: Properties of Matter (solids, liquids, and gases)*** • Use data and/or observations to identify patterns about the characteristic properties of different materials (e.g., metals have similar properties) **4. Using mathematics and computational thinking** ***Topic: Chemical and Physical Changes*** • 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) ***Topic: Properties of Matter (solids, liquids, and gases)*** • Organize the qualitative and quantitative information about characteristic properties of different materials (e.g., hardness, density)	**5. Developing and using models** ***Topic: Chemical and Physical Changes*** • Illustrate or develop a model to show/explain phase changes between gases, liquids, and solids ***Topic: Properties of Matter (solids, liquids, and gases)*** • Compare models of different substances in a specific phase to identify common features and differences. **6. Constructing explanations** ***Topic: Chemical and Physical Changes*** • Describe how substances change from liquid to gas and vice versa and/or liquids to solids and vice versa ***Topic: Properties of Matter (solids, liquids, and gases)*** • Describe the relationship between gases, liquids, and solids • Explain how to determine that the characteristic properties of a substance have changed **7. Engaging in argument from evidence** ***Topic: Chemical and Physical Changes*** • Use scientific evidence to support a claim about whether or not a chemical reaction occurred ***Topic: Properties of Matter (solids, liquids, and gases)*** • 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)

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Matter and Its Interactions (cont.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Chemical and Physical Changes*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about how objects change state ***Topic: Properties of Matter (solids, liquids, and gases)*** • Research and present information the characteristics of specific materials (e.g., are they absorbent, reflective, transparent; do they retain heat?)

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** ***Topic: Forces*** • Generate scientific questions about the forces that can act on an object ***Topic: Magnets*** • Use observations and/or data to ask relevant questions about magnets **2. Planning and carrying out investigations** ***Topic: Forces*** • Record observations (e.g., firsthand experiences, media) to collect data related to balanced and unbalanced forces on an object ***Topic: 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)	**3. Analyzing and interpreting data** ***Topic: Forces*** • Use data and/or observations to identify relationships between the forces acting on an object and changes in the motion of the object ***Topic: Magnets*** • 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) **4. Using mathematics and computational thinking** ***Topic: Forces*** • Use counting and numbers to show data about the how balanced and unbalanced forces may change the motion of an object ***Topic: Magnets*** • Organize the qualitative and quantitative information about interactions between two magnets with the orientation and/or distance between the magnets had changed	**5. Developing and using models** ***Topic: Forces*** • Illustrate or develop a model to show/explain the direction and magnitude of the forces acting on an object, including gravity ***Topic: Magnets*** • Illustrate or develop a model to show/explain the direction and magnitude of the forces between two magnets **6. Constructing explanations** ***Topic: Forces*** • Describe how gravity's direction is related to the Earth • Describe the relationship between balanced/unbalanced forces and changes in motion of an object ***Topic: Magnets*** • 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 **7. Engaging in argument from evidence** ***Topic: Forces*** • Use scientific evidence to support a claim that gravity is directed towards Earth's center ***Topic: Magnets*** • Use scientific evidence to support a claim as to why certain objects are magnetic while others are non-magnetic

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** ***Topic: Forces*** • 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 balanced or unbalanced forces affect the change in motion of an object ***Topic: Magnets*** • 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** ***Topic: Energy Transfer*** • Generate scientific questions about how energy transfers when two objects collide **2. Planning and carrying out investigations** ***Topic: Energy Transfer*** • 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)	**3. Analyzing and interpreting data** ***Topic: Energy Transfer*** • Use data and/or observations to identify relationships between energy transfers and sound/light/heat **4. Using mathematics and computational thinking** ***Topic: Energy Transfer*** • Use counting and numbers to show data about the growth of plants when exposed to different amounts of the sun's energy	**5. Developing and using models** ***Topic: Energy Transfer*** • 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 **6. Constructing explanations** ***Topic: Energy Transfer*** • Describe how energy is transferred when objects collide (e.g., motion, heat, light, sound) • Explain how the energy animals get from digested food originates from the sun's energy **7. Engaging in argument from evidence** ***Topic: Energy Transfer*** • 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) **8. Obtaining, evaluating, and communicating information** ***Topic: Energy Transfer*** • 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** ***Topic: Light and Sound*** • Use observations and/or data to ask relevant questions about how light allows eyes to see **2. Planning and carrying out investigations** ***Topic: Light and Sound*** • 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) • Record observations (e.g., firsthand experiences, media) to collect data related to how light reflects off of objects	**3. Analyzing and interpreting data** ***Topic: Light and Sound*** • 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 **4. Using mathematics and computational thinking** ***Topic: Light and Sound*** • Use counting and numbers to show data about which materials cause light waves to either be reflected, absorbed, or passed through • Organize the qualitative and quantitative information about the movement of objects and energy transferred by waves	**5. Developing and using models** ***Topic: Light and Sound*** • 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** ***Topic: Light and Sound*** • Describe how some materials allow waves to pass through while others cause waves to be absorbed or reflected **7. Engaging in argument from evidence** ***Topic: Light and Sound*** • Use scientific evidence to support a claim that light must reflect off an object and enter the eye for the object to be seen **8. Obtaining, evaluating, and communicating information** ***Topic: Light and Sound*** • 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

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 6

Core Idea	Learning Standard ID	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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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.
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.
Waves and Their Applications in Tech-nologies for Information Transfer	**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.
Waves and Their Applications in Tech-nologies for Information Transfer	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Physical Science

Grade Level: Grade 7

Core Idea	Learning Standard ID	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.
Motion and Stability: Forces and Interactions	**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.
Energy	**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.
Energy	**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 Standard ID	Learning Standards as written
Energy	**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.
Energy	**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.
Energy	**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.
Energy	**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 Standard ID	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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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.
Matter and Its Interactions	**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 Standard ID	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.
Motion and Stability: Forces and Interactions	**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** ***Topic: Chemical and Physical Changes*** • 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) • Generate scientific questions about the physical changes of substances based on research and/or observations ***Topic: Density*** • Identify scientific (testable) and non-scientific (non-testable) questions about the density of different materials **2. Planning and carrying out investigations** ***Topic: Chemical and Physical Changes*** • Record observations and/or measurements to produce data to serve as evidence for investigations about whether a chemical or physical change has occurred ***Topic: Density*** • Select and use appropriate methods and/or tools for collecting data in an investigation about density	**3. Analyzing and interpreting data** ***Topic: Chemical and Physical Changes*** • Use observations and/or data from an investigation to determine whether a chemical or physical change has occurred ***Topic: Density*** • Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the densities of different materials **4. Using mathematics and computational thinking** ***Topic: Chemical and Physical Changes*** • Organize simple data sets to reveal patterns about the rearrangement of atoms in chemical reactions ***Topic: Density*** • Calculate the density of objects using the ratio of the mass to the volume	**5. Developing and using models** ***Topic: Chemical and Physical Changes*** • 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) ***Topic: Density*** • Develop, revise, and/or use a model to show/explain how materials have different densities **6. Constructing explanations** ***Topic: Chemical and Physical Changes*** • Explain the relationship between the substances before (reactants) and after (products) a chemical reaction ***Topic: Density*** • Generate and compare multiple solutions to a problem related to density **7. Engaging in argument from evidence** ***Topic: Chemical and Physical Changes*** • Use scientific evidence and observations to construct an argument about whether a chemical or physical change occurred ***Topic: Density*** • Use scientific evidence and observations to construct an argument about whether or not a material will float in water

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** ***Topic: Chemical and Physical Changes*** • Combine scientific information from multiple sources to explain the effects of adding or removing thermal energy on a solid, liquid, and/or gas • Research and present information (e.g., from an investigation) to demonstrate the differences between physical and chemical changes ***Topic: Density*** • 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
Motion and Stability: Forces and Interactions	**1. Asking questions/defining problems** ***Topic: Forces*** • 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) **2. Planning and carrying out investigations** ***Topic: 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	**3. Analyzing and interpreting data** ***Topic: Forces*** Compare and contrast data showing the change in speed of objects with different masses when the same force is applied **4. Using mathematics and computational thinking** ***Topic: Forces*** • 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	**5. Developing and using models** ***Topic: Forces*** • Develop, revise, and/or use a model to show/explain the forces applied to both objects in a collision **6. Constructing explanations** ***Topic: Forces*** • 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 • Explain the relationship between distance and the strength of fields (i.e., electric, magnetic, gravitational) **7. Engaging in argument from evidence** ***Topic: Forces*** • Use scientific evidence and observations to construct an argument about the presence/absence of a field in a given scenario **8. Obtaining, evaluating, and communicating information** ***Topic: Forces*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about Newton's 1st, 2nd, and/or 3rd Law of Motion

ENTRY POINTS to
Physical Science Standards in Grades 6–8

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy	**1. Asking questions/defining problems** ***Topic: Kinetic and Potential Energy*** • Generate scientific questions about potential energy (e.g., electric, magnetic, gravitational) based on research and/or observations ***Topic: Thermal Energy Transfer*** • Generate scientific questions about convection, conduction, and/or radiation **2. Planning and carrying out investigations** ***Topic: Kinetic and Potential Energy*** • Record observations and/or measurements to produce data to serve as evidence for investigations about the relationship between kinetic energy, mass, and speed ***Topic: Thermal Energy Transfer*** • Plan and/or conduct an investigation about thermal energy transfer to produce data/observations to serve as evidence	**3. Analyzing and interpreting data** ***Topic: Kinetic and Potential Energy*** • Represent data visually (e.g., bar graphs, pictographs, and/or pie charts) to reveal patterns about the relationship between kinetic energy, mass, and speed ***Topic: Thermal Energy Transfer*** • Use observations and/or data from an investigation to determine the direction of thermal energy transfer **4. Using mathematics and computational thinking** ***Topic: Kinetic and Potential Energy*** • Organize simple data sets to reveal patterns about the relationship between kinetic energy, mass, and/or speed ***Topic: Thermal Energy Transfer*** • Organize simple data sets to reveal patterns about the direction of thermal energy transfer	**5. Developing and using models** ***Topic: Kinetic and Potential Energy*** • 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) ***Topic: Thermal Energy Transfer*** • 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 the process of convection, conduction, and/or radiation **6. Constructing explanations** ***Topic: Kinetic and Potential Energy*** • Explain the relationship between kinetic energy and mass and/or kinetic energy and speed ***Topic: Thermal Energy Transfer*** • Explain how energy is transferred through the process of convection, conduction, and/or radiation

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)			**7. Engaging in argument from evidence** ***Topic: Kinetic and Potential Energy*** • Use scientific evidence and observations to construct an argument about kinetic energy transfer in collisions ***Topic: Thermal Energy Transfer*** • Use scientific evidence and observations to construct an argument about the direction of thermal energy transfer **8. Obtaining, evaluating, and communicating information** ***Topic: Kinetic and Potential Energy*** • Research and present information about how energy can change from potential to kinetic and vice versa ***Topic: Thermal Energy Transfer*** • Combine scientific information from multiple sources to explain the relative effectiveness of materials to retain and/or radiate heat

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** ***Topic: Light and Sound*** • Identify scientific (testable) and non-scientific (non-testable) questions about light and/or mechanical waves • Generate scientific questions about light and/or mechanical waves based on research and/or observations **2. Planning and carrying out investigations** ***Topic: Light and Sound*** • Plan and/or conduct an investigation about the behavior of light and/or mechanical waves to produce data/observations to serve as evidence	**3. Analyzing and interpreting data** ***Topic: Light and Sound*** • Use observations and/or data from an investigation to determine the types of materials that absorb, reflect, and transmit light and/or mechanical waves **4. Using mathematics and computational thinking** ***Topic: Light and Sound*** • Organize simple data sets to reveal patterns about the characteristics of waves (e.g., amplitude, energy, frequency)	**5. Developing and using models** ***Topic: Light and Sound*** • 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 **6. Constructing explanations** ***Topic: Light and Sound*** • Explain how waves can be reflected, absorbed, and/or transmitted through a material **7. Engaging in argument from evidence** ***Topic: Light and Sound*** • Use scientific evidence and observations to construct an argument about which materials best reflect, absorb, or transmit light and/or sound **8. Obtaining, evaluating, and communicating information** ***Topic: Light and Sound*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the reflection, transmission, and absorption of light and/or mechanical waves

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	Page 134	Pages 136–137	Pages 141–142	Pages 147–148
Materials, Tools, and Manufacturing	Page 135			Pages 149–150

CONTENT Science and Technology/Engineering
DISCIPLINE Technology/Engineering

Grade Level: Grade 1

Core Idea	Learning Standard ID	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.
Engineering Design	**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 Standard ID	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

Instructions for creating access skills for Science and Technology/Engineering:

Select the access skill from **Step 1** and then choose and merge with content from the provided lists in **Step 2** for selected STE Core Idea.
Sample access skill for Core Idea of Engineering Design:

- *Move materials in an activity related to questions about engineering design*

Step 1: Select access skill student is addressing:

Access Skill:
○ Activate a device (within a specified amount of time) to participate in an activity related to… ○ Choose from an array of errorless choices (within a specified amount of time) to participate in an activity related to… ○ Grasp, release, or give materials in an activity related to… ○ Explore materials (tactilely) in an activity related to… ○ Track materials in an activity related to… ○ Functionally use materials in an activity related to… ○ Gain attention within a specified time block(s) to explore materials in an activity related to… ○ Imitate action in an activity related to… ○ Initiate cause and effect response in an activity related to… ○ Locate objects partially hidden or out of sight in an activity related to… ○ Make a request to explore materials in an activity related to… ○ Match object to object, or picture to picture of materials in an activity related to… ○ Move materials in an activity related to… ○ Orient or manipulate materials or a model in an activity related to… ○ Sustain exploration activity (e.g., vocalize when activity is interrupted) with materials in an activity related to… ○ Turn on/off technology within a specified amount of time in an activity related to…

ACCESS SKIILS to
Technology/Engineering Standards

Step 2: Choose the Core Idea content/topic in which data will be collected on the skill:

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design	**1. Asking questions/defining problems** ***Topic: Engineering Design*** • questions about engineering design **2. Planning and carrying out investigations** ***Topic: Engineering Design*** • investigations regarding engineering design	**3. Analyzing and interpreting data** ***Topic: Engineering Design*** • data about engineering design **4. Using mathematics and computational thinking** ***Topic: Engineering Design*** • counting or numbers regarding engineering design	**5. Developing and using models** ***Topic: Engineering Design*** • models involving engineering design **6. Constructing explanations** ***Topic: Engineering Design*** • terminology about engineering design **7. Engaging in argument from evidence** ***Topic: Engineering Design*** • facts about engineering design **8. Obtaining, evaluating, and communicating information** ***Topic: Engineering Design*** • sharing information about engineering design

ACCESS SKIILS to Technology/Engineering Standards

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Materials, Tools, and Manufac-turing	**1. Asking questions/defining problems** ***Topic: Properties of Materials*** • questions about the properties of materials ***Topic: Tools and Manufacturing*** • questions about tools and manufacturing **2. Planning and carrying out investigations** ***Topic: Properties of Materials*** • investigations regarding the properties of materials ***Topic: Tools and Manufacturing*** • investigations regarding tools and manufacturing	**3. Analyzing and interpreting data** ***Topic: Properties of Materials*** • data about the properties of materials ***Topic: Tools and Manufacturing*** • data about tools and manufacturing **4. Using mathematics and computational thinking** ***Topic: Properties of Materials*** • counting or numbers regarding the properties of materials ***Topic: Tools and Manufacturing*** • counting or numbers regarding tools and manufacturing	**5. Developing and using models** ***Topic: Properties of Materials*** • models involving the properties of materials ***Topic: Tools and Manufacturing*** • models involving tools and manufacturing **6. Constructing explanations** ***Topic: Properties of Materials*** • terminology about the properties of materials ***Topic: Tools and Manufacturing*** • terminology about tools and manufacturing **7. Engaging in argument from evidence** ***Topic: Properties of Materials*** • facts about the properties of materials ***Topic: Tools and Manufacturing*** • facts about tools and manufacturing **8. Obtaining, evaluating, and communicating information** ***Topic: Properties of Materials*** • sharing information about the properties of materials ***Topic: Tools and Manufacturing*** • sharing information about tools and manufacturing

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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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., first hand 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • Use scientific evidence in support of an argument about the best design solution for a problem

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** ***Topic: Engineering Design*** • 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 • Recall important information about a simple design problem or design solution from a text or media source

CONTENT Science and Technology/Engineering
DISCIPLINE Technology/Engineering

Grade Level: Grade 3

Core Idea	Learning Standard ID	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.
Engineering Design	**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.
Engineering Design	**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 Standard ID	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.
Engineering Design	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Technology/Engineering

Grade Level: Grade 5

Core Idea	Learning Standard ID	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.
Techno-logical Systems	**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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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., first hand experiences, media) to collect data related on a simple design problem or a design solution	**3. Analyzing and interpreting data** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • Describe a design solution to a simple design problem • Describe the relationship between a problem and its intended solution • 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** ***Topic: Engineering Design*** • 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

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

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Engineering Design (cont.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Engineering Design*** • Research and present information about a simple design problem or a design solution • 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

CONTENT Science and Technology/Engineering
DISCIPLINE Technology/Engineering

Grade Level: Grade 6

Core Idea	Learning Standard ID	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.
Engineering Design	**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.
Engineering Design	**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.
Materials, Tools, and Manu-facturing	**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.
Materials, Tools, and Manu-facturing	**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.

CONTENT Science and Technology/Engineering
DISCIPLINE Technology/Engineering

Grade Level: Grade 7

Core Idea	Learning Standard ID	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. *
Engineering Design	**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. *
Engineering Design	**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.
Techno-logical Systems	**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.
Techno-logical Systems	**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 Standard ID	Learning Standards as written
Techno-logical Systems	**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).
Techno-logical Systems	**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 Standard ID	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.
Materials, Tools, and Manu-facturing	**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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • Develop, revise, and or use a model to show/explain a problem or design solution **6. Constructing explanations** ***Topic: Engineering Design*** • Explain the criteria/constraints of a problem (e.g., potential impacts on people and the environment) • Explain the elements of 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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** ***Topic: Engineering Design*** • 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

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 Manu-facturing	**1. Asking questions/defining problems** ***Topic: Properties of Materials*** • Identify scientific (testable) and non-scientific (non-testable) questions about the materials (e.g., metals, plastics, wood, ceramic) ***Topic: Tools and Manufacturing*** • 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) **2. Planning and carrying out investigations** ***Topic: Properties of Materials*** • 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 • Record observations and/or measurements to produce data to serve as evidence for selecting a material for an intended purpose ***Topic: Tools and Manufacturing*** • 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	**3. Analyzing and interpreting data** ***Topic: Properties of Materials*** • 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 • Compare and contrast the result of a design solution to the criteria/constraints of the design problem that requires the evaluation of materials ***Topic: Tools and Manufacturing*** • Use observations and/or data to determine the most appropriate tool (e.g., hand tool, power tool) for constructing a prototype • 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 • 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** ***Topic: Properties of Materials*** • 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 ***Topic: Tools and Manufacturing*** • 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 **6. Constructing explanations** ***Topic: Properties of Materials*** • Explain why a specific material was selected to accomplish a design task based on the material's properties (e.g., weight, strength, hardness, flexibility) ***Topic: Tools and Manufacturing*** • Explain the constraints of using measuring tools, hand tools, fasteners, and/or power tools for defining a problem or constructing a solution • Explain the elements of the manufacturing processes (e.g., forming, separating, conditioning, assembling, finishing, quality control, safety) for a design solution • 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 Manu-facturing (cont.)		**4. Using mathematics and computational thinking** ***Topic: Properties of Materials*** • Organize simple data sets to reveal patterns about the materials (e.g., metals, plastics, wood, ceramic) 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 materials that could be used for a design solution ***Topic: Tools and Manufacturing*** • 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)	**7. Engaging in argument from evidence** ***Topic: Properties of Materials*** • Use scientific evidence to support an argument about the solution that best fits a problem's criteria/constraints related to material properties ***Topic: Tools and Manufacturing*** • Use scientific evidence to support an argument about the tools used to define a problem or construct solution **8. Obtaining, evaluating, and communicating information** ***Topic: Properties of Materials*** • Communicate (orally, graphically, textually, and/or mathematically) scientific information or ideas about the materials used in a design solution and their properties ***Topic: Tools and Manufacturing*** • 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

Science and Technology/Engineering
High School

BIOLOGY

Core Idea	Access Skills	High School
From Molecules to Organisms: Structures and Processes	Pages 49–52	Pages 157–158
Ecosystems: Interactions, Energy, and Dynamics	Pages 53–54	Pages 159–160
Heredity: Inheritance and Variation of Traits	Page 55	Page 161
Biological Evolution: Unity and Diversity	Pages 56–57	Pages 162–163

Grade Level: High School

Core Idea	Learning Standard ID	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.
From Molecules to Organisms: Structures and Processes	**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).
From Molecules to Organisms: Structures and Processes	**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.
From Molecules to Organisms: Structures and Processes	**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.

Core Idea	Learning Standard ID	Learning Standards as written
From Molecules to Organisms: Structures and Processes	**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
From Molecules to Organisms: Structures and Processes	**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.
From Molecules to Organisms: Structures and Processes	**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.

Core Idea	Learning Standard ID	Learning Standards as written
Ecosystem: Interaction, Energy, and Dynamics	**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.
Ecosystem: Interaction, Energy, and Dynamics	**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).
Ecosystem: Interaction, Energy, and Dynamics	**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.
Ecosystem: Interaction, Energy, and Dynamics	**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.

Core Idea	Learning Standard ID	Learning Standards as written
Ecosystem: Interaction, Energy, and Dynamics	**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.
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).
Heredity: Inheritance and Variation of Traits	**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.
Heredity: Inheritance and Variation of Traits	**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.

Core Idea	Learning Standard ID	Learning Standards as written
Heredity: Inheritance and Variation of Traits	**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.
Biological Evolution: Unity and Diversity	**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.
Biological Evolution: Unity and Diversity	**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.
Biological Evolution: Unity and Diversity	**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.

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** ***Topic: Body Systems*** • 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) ***Topic: Cells and Cell Structures*** • Generate a testable scientific question about which substances are capable of crossing a semi-permeable membrane **2. Planning and carrying out investigations** ***Topic: Body Systems*** • Select the best method to collect data and/or observations about how body systems work together (e.g., digestive, respiratory, circulatory, excretory, and nervous systems) ***Topic: Cells and Cell Structures*** • Plan and/or follow the steps of an investigation to examine mitosis in living cells (e.g., root tip lab)	**3. Analyzing and interpreting data** ***Topic: Body Systems*** • 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 ***Topic: Cells and Cell Structures*** • Analyze data from a table or graph to determine which solution best matches the solute concentration of the living cells (e.g., potato cores) **4. Using mathematics and computational thinking** ***Topic: Body Systems*** • Apply mathematical concepts and/or processes (ratios, percentages, proportions, and/or basic operations) from an investigation about how body systems work together (e.g., digestive, respiratory, circulatory, excretory, and nervous systems) ***Topic: Cells and Cell Structures*** • Use mathematical concepts to calculate the change in mass of living cells (e.g., potato cores) exposed to different types of solutions.	**5. Developing and using models** ***Topic: Body Systems*** • Use a model of negative feedback loops to show homeostasis (e.g., regulation of blood glucose or body temperature) ***Topic: Cells and Cell Structures*** • 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 **6. Constructing explanations** ***Topic: Body Systems*** • 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.) ***Topic: Cells and Cell Structures*** • 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) **7. Engaging in argument from evidence** ***Topic: Body Systems*** • 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 ***Topic: Cells and Cell Structures*** • 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

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** ***Topic: Body Systems*** • Communicate (orally, graphically, textually, and/or mathematically) scientific information about how body systems (digestive, respiratory, circulatory, excretory, nervous) work together to maintain life functions ***Topic: Cells and Cell Structures*** • Research, record, and present information showing how body systems work together to deliver oxygen and nutrients to cells and remove waste products from cells

ENTRY POINTS to
Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystem: Interaction, Energy, and Dynamics	**1. Asking questions/defining problems** ***Topic: Ecological Relationships*** • 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 **2. Planning and carrying out investigations** ***Topic: Ecological Relationships*** • Plan and/or follow the steps of an investigation to collect data from a predator-prey simulation	**3. Analyzing and interpreting data** ***Topic: Ecological Relationships*** • 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** ***Topic: Ecological Relationships*** • 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** ***Topic: Ecological Relationships*** • 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?) • 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 of an ecosystem to describe the abiotic and biotic factors in the ecosystem **6. Constructing explanations** ***Topic: Ecological Relationships*** • Construct an explanation of how changes to an ecosystem affect carrying capacity based on a variety of sources (e.g., model, research, investigation, simulation) **7. Engaging in argument from evidence** ***Topic: Ecological Relationships*** • 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)

ENTRY POINTS to
Biology Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Ecosystem: Interaction, Energy, and Dynamics (cont.)			**8. Obtaining, evaluating, and communicating information** ***Topic: Ecological Relationships*** • Research, record, and present information showing how abiotic and biotic factors influence the carrying capacity of a population • Research, record, and/or present information describing examples of symbiotic relationships (e.g., parasitism, commensalism, and mutualism) within an ecosystem

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** ***Topic: Traits*** • 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 **2. Planning and carrying out investigations** ***Topic: Traits*** • 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** ***Topic: Traits*** • Analyze data from a table or graph (e.g. pedigree chart) to determine the inheritance pattern for a specific trait • Analyze data from a Punnett square or pedigree to determine the inheritance patterns of a particular trait **4. Using mathematics and computational thinking** ***Topic: Traits*** • 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** ***Topic: Traits*** • Construct a pedigree chart to demonstrate how a sex-linked trait is passed across multiple generations **6. Constructing explanations** ***Topic: Traits*** • 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) **7. Engaging in argument from evidence** ***Topic: Traits*** • Use scientific evidence and observations to construct an argument about the inheritance pattern of a particular trait **8. Obtaining, evaluating, and communicating information** ***Topic: Traits*** • Research, record, and present information showing how the genetic information in chromosomes is passed from parents to offspring • Communicate (orally, graphically, textually, and/or mathematically) scientific information about how an inherited mutation can become a source of new traits within a population

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	**1. Asking questions/defining problems** ***Topic: Evolution*** • Generate scientific questions based on observations or data about the evolution of a species **2. Planning and carrying out investigations** ***Topic: Evolution*** • 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 • Plan and/or follow the steps of an investigation to simulate antibiotic resistance in bacteria	**3. Analyzing and interpreting data** ***Topic: Evolution*** • 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) **4. Using mathematics and computational thinking** ***Topic: Evolution*** • Apply mathematical concepts (e.g., ratios, percentages, proportions) to changes in traits over time in a population undergoing evolution	**5. Developing and using models** ***Topic: Evolution*** • 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 **6. Constructing explanations** ***Topic: Evolution*** • 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) **7. Engaging in argument from evidence** ***Topic: Evolution*** • Make and defend a claim about evolution based on the fossil record (e.g., whales were descended from land mammals, homologous structures). • 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) • Make and defend a claim about natural selection using Darwin's observations of structural differences in the beaks of finches

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** ***Topic: Evolution*** • 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 98–99	Page 169
Motion and Stability: Forces and Interactions	Pages 100–101	Pages 170–171
Energy	Pages 102–103	Pages 172–173
Waves and Their Applications in Technologies for Information Transfer	Page 104	Page 174

Grade Level: High School

Core Idea	Learning Standard ID	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.
Motion and Stability: Forces and Interactions	**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.
Motion and Stability: Forces and Interactions	**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.
Motion and Stability: Forces and Interactions	**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.

Core Idea	Learning Standard ID	Learning Standards as written
Motion and Stability: Forces and Interactions	**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.
Motion and Stability: Forces and Interactions	**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.
Motion and Stability: Forces and Interactions	**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.
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.

Core Idea	Learning Standard ID	Learning Standards as written
Energy	**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.
Energy	**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.
Energy	**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.
Energy	**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.

Core Idea	Learning Standard ID	Learning Standards as written
Waves and Their Applications in Technol-ogies 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.
Waves and Their Applications in Technol-ogies for Information Transfer	**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.
Waves and Their Applications in Technol-ogies for Information Transfer	**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.

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*.]	[Standards for this core idea at High School level are aligned with Chemistry.]	[Standards for this core idea at High School level are aligned with Chemistry.]

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	**1. Asking questions/defining problems** ***Topic: Circuits*** • 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 ***Topic: Forces*** • 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 • Evaluate a scientific question to determine if it is testable and/or relevant to momentum conservation in a collision **2. Planning and carrying out investigations** ***Topic: Circuits*** • Plan and/or follow the steps of an investigation to collect data on the voltage drop across resistors in series and in parallel ***Topic: Forces*** • 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	**3. Analyzing and interpreting data** ***Topic: Circuits*** • 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 ***Topic: Forces*** • 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 **4. Using mathematics and computational thinking** ***Topic: Circuits*** • 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 ***Topic: Forces*** • Use the formula F_{net} = ma to solve for the acceleration, net force, or mass of an object	**5. Developing and using models** ***Topic: Circuits*** • Construct a circuit diagram (model) using proper schematic symbols ***Topic: Forces*** • Construct a free-body force diagram (model) of the forces acting on an object **6. Constructing explanations** ***Topic: Circuits*** • Apply scientific ideas or principles to design and construct a prototype of a circuit that meets given criteria ***Topic: Forces*** • 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) **7. Engaging in argument from evidence** ***Topic: Circuits*** • Use scientific evidence to construct an argument about whether series or parallel circuits should be used in homes ***Topic: Forces*** • 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)

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** ***Topic: Circuits*** • Evaluate the validity of claims comparing series and parallel circuits ***Topic: Forces*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about the effectiveness of a safety device used in collisions (e.g., airbags, seatbelts, crushable bumpers, parachutes)

ENTRY POINTS to
Introductory Physics Standards in High School

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy	**1. Asking questions/defining problems** ***Topic: Kinetic and Potential Energy*** • 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 ***Topic: Thermal Energy Transfer*** • Generate a scientific question that is testable about how adding heat to a substance affects the temperature of the substance, using available resources **2. Planning and carrying out investigations** ***Topic: Kinetic and Potential Energy*** • 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) ***Topic: Thermal Energy Transfer*** • 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 • Select and use appropriate tools to conduct an investigation about the thermal energy transfer between two substances	**3. Analyzing and interpreting data** ***Topic: Kinetic and Potential Energy*** • 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 ***Topic: Thermal Energy Transfer*** • 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** ***Topic: Kinetic and Potential Energy*** • Use the formula, KE = /12^2, to solve for the kinetic energy, mass, or speed of an object. ***Topic: Thermal Energy Transfer*** • 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	**5. Developing and using models** ***Topic: Kinetic and Potential Energy*** • Construct or revise models to show the mechanical energy of an object remains constant when the only force acting on the object is gravity ***Topic: Thermal Energy Transfer*** • Use a model of the particle motion and spatial arrangement in a substance to determine if the substance is a solid, liquid, or gas **6. Constructing explanations** ***Topic: Kinetic and Potential Energy*** • 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) ***Topic: Thermal Energy Transfer*** • 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)

Core Idea	Investigations and Questioning	Mathematics and Data	Evidence, Reasoning, and Modeling
Energy (cont.)			**7. Engaging in argument from evidence** ***Topic: Kinetic and Potential Energy*** • 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 ***Topic: Thermal Energy Transfer*** • Use scientific evidence and observations to construct an argument about how the materials selected for a design solution affect energy transfer **8. Obtaining, evaluating, and communicating information** ***Topic: Kinetic and Potential Energy*** • Communicate scientific information or ideas (orally, graphically, textually, and/or mathematically) about what factors affect the gravitational potential energy of an object ***Topic: Thermal Energy Transfer*** • 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

ENTRY POINTS to
Introductory Physics Standards in High School

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** ***Topic: Light and Sound*** • Generate a scientific question about waves that is testable using available resources **2. Planning and carrying out investigations** ***Topic: Light and Sound*** • 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) • 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** ***Topic: Light and Sound*** • Analyze data from a table to compare the speeds of a sound wave through solids, liquids, and gases **4. Using mathematics and computational thinking** ***Topic: Light and Sound*** • Use the formula $v = \lambda f$, to solve for the speed, wavelength, or frequency of a wave	**5. Developing and using models** ***Topic: Light and Sound*** • Construct a model to explain the behavior of a wave (resonance, reflection, refraction, diffraction, interference) **6. Constructing explanations** ***Topic: Light and Sound*** • Construct an explanation for how a technology/device (e.g., microwave, radio antenna, Wi-Fi) uses wave behaviors to function properly **7. Engaging in argument from evidence** ***Topic: Light and Sound*** • 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** ***Topic: Light and Sound*** • 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) • Communicate (orally, graphically, textually) scientific information or ideas about phenomena related to wave behaviors (interference, diffraction, resonance, reflection, refraction)