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DEPARTMENT OF EDUCATION
Learning. Leadership. Service.

South Dakota Science Standards

Adopted April 22, 2024

Contents

Introduction

In 2023, the Science Content Standards Revision Committee was tasked with reviewing the science standards as part of the standards revision cycle-Content Standards. The South Dakota Science Standards have undergone many hours of discussion by experienced K-12 educators, parents, and science professionals. The focus of the team was to ensure best practices were built into the standards while making sure they are also rigorous, attainable, and user friendly.

The Next Generation Science Standards (national standards) and *A Framework for K-12 Science Education* were used as a reference for the South Dakota Science Standards. The South Dakota Science Standards are written to include the dimension of Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts. The Science and Engineering Practices are the skill that students will use to help make sense of the science they are learning or exploring. The four domains; physical science, life science, earth and space science, and engineering, technology, and applications of science and the conceptual ideas that guide students in their thinking to develop a connected understanding of real-world phenomena and practical solutions to the problem are the Disciplinary Core Ideas. Crosscutting Concepts are a way to include the patterns across the different domains of science, such as cause and effect or energy and matter.

The integration of rigorous practices, core ideas, and concepts reflects how science and engineering are applied and practiced in our everyday lives. The standards are written as a progression of knowledge that occurs from grade band to grade band that allows for students the opportunity for the application of concepts and deeper understandings. The South Dakota Science Standards are written to the expectation of student outcomes. They are written to build coherently from Kindergarten through Grade Twelve.

The concepts and content in the science standards represent the most current research in science and science education. All theories are presented in a way that allow teachers to structure an experience around multiple pieces of scientific evidence and competing ideas to allow students to engage in an objective discussion. These standards were developed in such a manner to encourage students to analyze all forms of scientific evidence and draw their own conclusions.

Through the public hearing process, past and present, related to adoption of the South Dakota Science Standards, it is evident that there is particular sensitivity to two issues: climate change and evolution. The South Dakota Board of Education recognizes that parents are their children's first teachers, and that parents play a critical role in their children's formal education. The South Dakota Board of Education also recognizes that not all viewpoints can be covered in the science classroom. Therefore, the board recommends that parents engage their children in discussions regarding these important issues, in order that South Dakota students are able to analyze all forms of evidence and argument and draw their own conclusions.

The standards document provides a workable synthesis of transparency, public input, and scientific consensus. They are written to ensure that our students will have the knowledge, skills, and competencies to be college, career, and life ready.

Science Standards Advisory Committee

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Notable Adjustments

With an ever-changing world and research showing hands-on activities help our students learn best, the engineering design standards were previously a separate document and embedded into the standards. The standards continue to align with and follow the core ideas, science and engineering practices, and crosscutting concepts to help ensure our students learn the most about science. These are now listed within the science standards. The engineering design science standards were also aligned with the other areas of science; Physical, Life, Earth and Space Sciences and are listed in grade bands. The alignment is a recommendation of when it can be taught. Engineering standards are not standards that are taught as a stand-alone lesson or skill. Engineering, Technology, and Application of Science Standards go hand in hand with inquiry-based learning. This is an approach to learning that encourages students to engage in experiential learning and problem-solving that will meet both the standards of the discipline and the engineering.

Throughout the standards, minor language changes were made for clarification and consistency purposes. The language that was used came from the Science and Engineering Practices, Disciplinary Core Ideas and the Crosscutting Concepts from *A Framework for K-12 Science Education.* These ideas are also aligned with the Next Generation Science Standards (NGSS).

(2011). *A Framework for K-12 Science Education: Practices, crosscutting concepts, and core ideas.* Washington, DC: The National Academies Press. Retrieved from http://www.nap.edu/catalog.php?record_id=13165

How to read the South Dakota Science Standards

The standards are labeled to allow teachers and parents to gain a better understanding of what is expected of their child to study without having to be up to date on the most recent systems in education administration. The three dimensions of science referenced from *A Framework for K-12 Science Education* can be found in parentheses in every standard. The three dimensions include Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts. This information can be used to interpret a deeper meaning.

K-PS2-2	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. (**SEP: 4; DCI: PS2.A; CCC: Cause/Effect**) Alignment may include **K-2-ETS1-1**

K = Kindergarten **PS** = Physical Science **2** = Core Idea 2 **2** = Standard Number

- **SEP: 4** = Science and Engineering Practice: Analyzing and Interpreting Data
- **DCI: PS2.A** = Disciplinary Core Idea: Physical Science; Motion and Stability: Forces and Interactions, Forces and Motion
- **CCC: Cause/Effect** = Crosscutting Concept: Cause and Effect
- **K-2-ETS1-1** = K-2 = grade band, ETS = Engineering, Technology, and Application of Sciences, 1-1 = the ETS embedded standard alignment

Below is a legend to decode the components that are in parentheses at the end of each standard.

Science and Engineering Practices (SEP)

1. Asking Questions and Defining Problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

Framework (2012) p. 41

Disciplinary Core Idea (DCI)

These are listed as written in *A Framework for K-12 Science Education*. For example, PS1 stands for Physical Science Core Idea 1: Matter and Its Interactions. You will notice that next to the standard it will read, for example, PS1.A. In this case, the coding is referring to Physical Science Core Idea 1: Matter and Its Interactions, Component Idea A: Structure and Properties of Matter.

PS = Physical Science

LS = Life Science

ESS = Earth and Space Science

ETS = Engineering, Technology, and Applications of Sciences

Framework (2012) p. 103

Core Ideas in the Physical Sciences

Core Idea PS1: Matter and Its Interactions

PS1.A: Structure and Properties of Matter
PS1.B: Chemical Reactions
PS1.C: Nuclear Processes

Core Idea PS2: Motion and Stability: Forces and Interactions

PS2.A: Forces and Motion
PS2.B: Types of Interactions
PS2.C: Stability and Instability in Physical Systems

Core Idea PS3: Energy

PS3.A: Definitions of Energy
PS3.B: Conservation of Energy and Energy Transfer
PS3.C: Relationship Between Energy and Forces
PS3.D: Energy in Chemical Processes and Everyday Life

Core Idea PS4: Waves and Their Applications in Technologies for Information Transfer

PS4.A: Wave Properties
PS4.B: Electromagnetic Radiation
PS4.C: Information Technologies and Instrumentation

Framework (2012) p. 105

Core Ideas in the Life Sciences

Core Idea LS1: From Molecules to Organisms: Structures to Processes

- LS1.A: Structure and Function
- LS1.B: Growth and Development of Organisms
- LS1.C: Organization for Matter and Energy Flow in Organisms
- LS1.D: Information Processing

Core Idea LS2: Ecosystems: Interactions, Energy, and Dynamics

- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- LS2.D: Social Interactions and Group Behavior

Core Idea LS3: Heredity: Inheritance and Variation of Traits

- LS3.A: Inheritance of Traits
- LS3.B: Variation of Traits

Core Idea LS4: Biological Unity and Diversity

- LS4.A: Evidence of Common Ancestry and Diversity
- LS4.B: Natural Selection
- LS4.C: Adaptation
- LS4.D: Biodiversity and Humans

Framework (2012) p. 142

Core Ideas in the Earth and Space Sciences

Core Idea ESS1: Earth's Places in the Universe

ESS1.A: The Universe and Its Stars
ESS1.B: Earth and the Solar System
ESS1.C: The History of Planet Earth

Core Idea ESS2: Earth's Systems

ESS2.A: Earth Materials and Systems
ESS2.B: Plate Tectonics and Large-Scale System Interactions
ESS2.C: The Roles of Water in Earth's Surface Processes
ESS2.D: Weather and Climate
ESS2.E: Biogeology

Core Idea ESS3: Earth and Human Activity

ESS3.A: Natural Resources
ESS3.B: Natural Hazards
ESS3.C: Human Impacts on Earth's Systems
ESS3.D: Global Climate Change

Framework (2012) p. 171

Core Ideas in Engineering, Technology, and Applications of Science

Core Idea ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem
ETS1.B: Developing Possible Solutions
ETS1.C: Optimizing the Design Solution

Core Idea ETS2: Links Among Engineering, Technology, Science, and Society

ETS2.A: Interdependence of Science, Engineering, and Technology
ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World

Framework (2012) p. 203

Crosscutting Concept (CCC)

Patterns = Patterns
Cause/Effect = Cause and Effect
Scale/Prop. = Scale, Proportion, and Quantity
Systems = Systems and System Models
Energy/Matter = Energy and Matter
Structure/Function = Structure and Function
Stability/Change = Stability and Change

Framework (2012) p. 83

Kindergarten

Physical Science

Core Ideas

PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

PS3: Energy

- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces

K-PS2-1	Plan and carry out an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (SEP: 3; DCI: PS2.A, PS2.B, PS3.C; CCC: Cause/Effect)
K-PS2-2	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. (SEP: 4; DCI: PS2.A, ETS1.A; CCC: Cause/Effect) Alignment may include K-2-ETS1-1
K-PS3-1	Make observations to determine the effect of sunlight on Earth's surface. (SEP: 3; DCI: PS3.B; CCC: Cause/Effect)
K-PS3-2	Design and build a structure that will reduce the warming effect of sunlight on an area. (SEP: 6; DCI: PS3.B, ETS1.B; CCC: Cause/Effect) Alignment may include K-2-ETS1-2

Life Science

Core Idea

LS1: From Molecules to Organisms: Structures and Processes

- LS1.C: Organization for Matter and Energy Flow in Organisms

K-LS1-1	Describe patterns of what plants and animals (including humans) need to survive. (SEP: 4; DCI: LS1.C; CCC: Patterns)

Earth and Space Science

Core Ideas

ESS2: Earth's Systems

- ESS2.D: Weather and Climate
- ESS2.E: Biogeology

ESS3: Earth and Human Activity

- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth's Systems

K-ESS2-1	Plan and carry out observations of local weather conditions to describe patterns over time. (SEP: 4; DCI: ESS2.D; CCC: Patterns)
K-ESS2-2	Engage in argument from evidence for how plants and animals (including humans) can change the environment to meet their needs. (SEP: 7; DCI: ESS2.E, ESS3.C; CCC: Systems)

K-ESS3-1	Use a model to represent the characteristics of and the relationship between various plants and animals in the places they live. (SEP: 2; DCI: ESS3.A; CCC: Systems)
K-ESS3-2	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. (SEP: 1, 8; DCI: ESS3.B, ETS1.A; CCC: Cause/Effect) Alignment may include K-2-ETS1-1
K-ESS3-3	Communicate solutions that will reduce the impact of humans on the land, water, air, and living things in the local environment. (SEP: 8; DCI: ESS3.C, ETS1.B; CCC: Cause/Effect) Alignment may include K-2-ETS1-2

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

ETS1.B: Developing Possible Solutions

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. Alignment may include K-PS2-2; K-ESS3-2; 1-LS1-1
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. Alignment may include K-ESS3-3; 1-PS4-4; 2-LS2-2
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. Alignment may include 2-PS1-2; 2-ESS2-1

1st Grade Science

Physical Science

Core Ideas

PS4: Waves and Their Applications in Technologies for Information Transfer

PS4.A: Wave Properties

PS4.B: Electromagnetic Radiation

PS4.C: Information Technologies and Instrumentation

1-PS4-1	Plan and carry out an investigation to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. (SEP: 3; DCI: PS4.A; CCC: Cause/Effect)
1-PS4-2	Construct an evidence-based account for how objects can be seen only when illuminated. (SEP: 6; DCI: PS4.B; CCC: Cause/Effect)
1-PS4-3	Plan and carry out an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. (SEP: 3; DCI: PS4.B; CCC: Cause/Effect)
1-PS4-4	Design and build a device that uses light or sound to solve the problem of communicating over a distance. (SEP: 6; DCI: PS4.C, ETS1.B; CCC: Cause/Effect) Alignment may include K-2-ETS1-2

Life Science

Core Ideas

LS1: From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function

LS1.B: Growth and Development of Organisms

LS3: Heredity: Inheritance and Variation of Traits

LS3.A: Inheritance of Traits

LS3.B: Variation of Traits

1-LS1-1	Construct an explanation and design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. (SEP: 6; DCI: LS1.A, LSI.D, ETS1.A; CCC: Structure/Function) Alignment may include K-2-ETS1-1
1-LS1-2	Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. (SEP: 8; DCI: LS1.B; CCC: Patterns)
1-LS3-1	Construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. (SEP: 6; DCI: LS3.A, LS3.B; CCC: Patterns)

Earth and Space Science

Core Ideas

ESS1: Earth's Place in the Universe

ESS1.A: The Universe and Its Stars

ESS1.B: Earth and the Solar System

1-ESS1-1	Use observations of the sun, moon, and stars to describe patterns that can be predicted. (SEP: 4; DCI: ESS1.A; CCC: Patterns)
1-ESS1-2	Make observations and compare the amount of daylight at different times of the year. (SEP: 3; DCI: ESS1.B; CCC: Patterns)

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

ETS1.B: Developing Possible Solutions

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. Alignment may include K-PS2-2; K-ESS3-2; 1-LS1-1
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. Alignment may include K-ESS3-3; 1-PS4-4; 2-LS2-2
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. Alignment may include 2-PS1-2; 2-ESS2-1

2nd Grade Science

Physical Science

Core Ideas

PS1: Matter and Its Interactions

PS1.A: Structure and Properties of Matter

PS1.B: Chemical Reactions

2-PS1-1	Plan and carry out an investigation to describe and classify different kinds of materials by their observable properties. (SEP: 3; DCI: PS1.A; CCC: Patterns)
2-PS1-2	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (SEP: 4; DCI: PS1.A, ETS1.C; CCC: Cause/Effect) Alignment may include K-2-ETS1-3
2-PS1-3	Construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. (SEP: 6; DCI: PS1.A; CCC: Energy/Matter)
2-PS1-4	Construct an evidenced-based argument using reasoning and evidence that some changes caused by heating or cooling can be reversed and some cannot. (SEP: 7; DCI: PS1.B; CCC: Cause/Effect)

Life Science

Core Ideas

LS2: Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems

LS4: Biological Unity and Diversity

LS4.D: Biodiversity and Humans

2-LS2-1	Plan and carry out an investigation to determine if plants need sunlight and water to grow. (SEP: 3; DCI: LS2.A; CCC: Cause/Effect)
2-LS2-2	Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. (SEP: 2; DCI: LS2.A, ETS1.B; CCC: Structure/Function) Alignment may include K-2ETS1-2
2-LS4-1	Make observations of plants and animals to compare the diversity of life in different habitats. (SEP: 3; DCI: LS4.D; CCC: Systems)

Earth and Space Science

Core Ideas

ESS1: Earth's Place in the Universe

ESS1.C: The History of Planet Earth

ESS2: Earth's Systems

ESS2.A: Earth Materials and Systems

ESS2.B: Plate Tectonics and Large-Scale System Interactions

ESS2.C: The Roles of Water in Earth's Surface Processes

2-ESS1-1	Use information from several sources to construct an explanation that Earth events like volcanic eruptions, earthquakes, weather, and erosion can occur quickly or slowly. (SEP: 6; DCI: ESS1.C; CCC: Stability/Change)
2-ESS2-1	Compare multiple solutions to develop a model designed to slow or prevent wind or water from changing the shape of the land. (SEP: 6; DCI: ESS2.A, ETS1.C; CCC: Stability/Change) Alignment may include K-2-ETS1-3
2-ESS2-2	Obtain and evaluate information about the shapes and kinds of land and bodies of water in your local areas. (SEP: 8; DCI: ESS2.B; CCC: Stability/Change)
2-ESS2-3	Obtain information to identify where water is found on Earth and that it can be solid, liquid, or gas. (SEP: 8; DCI: ESS2.C; CCC: Patterns)

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

ETS1.B: Developing Possible Solutions

ETS1.C: Optimizing the Design Solution

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. Alignment may include K-PS2-2; K-ESS3-2; 1-LS1-1
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. Alignment may include K-ESS3-3; 1-PS4-4; 2-LS2-2
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. Alignment may include 2-PS1-2; 2-ESS2-1

3rd Grade Science

Physical Science

Core Ideas

PS2: Motion and Stability: Forces and Interactions

PS2.A: Forces and Motion

PS2.B: Types of Interactions

3-PS2-1	Plan and carry out an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (SEP: 3; DCI: PS2.A, PS2.B; CCC: Cause/Effect)
3-PS2-2	Make observations and/or measurements of an object's motion to provide evidence for how a pattern can be used to predict future motion. (SEP: 3; DCI: PS2.A; CCC: Patterns)
3-PS2-3	Ask questions about cause-and-effect relationships of electric or magnetic interactions between two objects not in contact with each other. (SEP: 1; DCI: PS2.B; CCC: Cause/Effect)
3-PS2-4	Define a simple design problem that can be solved by applying scientific ideas about magnets. (SEP: 1; DCI: PS2.B, ETS1.A; CCC: Cause/Effect) Alignment may include 3-5-ETS1-1

Life Science

Core Ideas

LS1: From Molecules to Organisms: Structures and Processes

LS1.B: Growth and Development of Organisms

LS2: Ecosystems: Interactions, Energy, and Dynamics

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS2.D: Social Interactions and Group Behavior

LS3: Heredity: Inheritance and Variation of Traits

LS3.A: Inheritance of Traits

LS3.B: Variation of Traits

LS4: Biological Unity and Diversity

LS4.A: Evidence of Common Ancestry and Diversity

LS4.B: Natural Selection

LS4.C: Adaptation

LS4.D: Biodiversity and Humans

3-LS1-1	Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death. (SEP: 1; DCI: LS1.B; CCC: Patterns)
3-LS2-1	Construct an argument that some animals form groups that help members survive. (SEP: 7; DCI: LS2.D; CCC: Cause/Effect)

3-LS3-1	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variations of these traits exist in a group of similar organisms. (SEP: 4; DCI: LS3.A, LS3.B; CCC: Patterns)
3-LS3-2	Use evidence and reasoning to support the explanation that traits can be influenced by the environment. (SEP: 6; DCI: LS3.A, LS3.B; CCC: Cause/Effect)
3-LS4-1	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. (SEP: 4; DCI: LS4.A; CCC: Scale/Prop.)
3-LS4-2	Use evidence and reasoning to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. (SEP: 6; DCI: LS4.B; CCC: Cause/Effect)
3-LS4-3	Construct an argument with evidence how some organisms thrive, some struggle to survive, and some cannot survive in a particular habitat. (SEP: 7; DCI: LS4.C; CCC: Cause/Effect)
3-LS4-4	Make an evidence-based claim about the validity of a solution to a change in the environment that affects the types of plants and animals that live there. (SEP: 7; DCI: LS2.C, LS4.D, ETS1.A; CCC: Systems) Alignment may include 3-5-ETS1-1

Earth and Space Science

Core Ideas

ESS2: Earth's Systems

ESS2.D: Weather and Climate

ESS3: Earth and Human Activity

ESS3.B: Natural Hazards

3-ESS2-1	Represent data in tables and graphical displays to describe weather conditions during a particular season. (SEP: 4; DCI: ESS2.D; CCC: Patterns)
3-ESS2-2	Obtain and combine information to describe climates in different regions of the world. (SEP: 8; DCI: ESS2.D; CCC: Patterns)
3-ESS3-1	Make an evidence-based claim about the validity of a design solution that reduces the impacts of a weather-related hazard. (SEP: 7; DCI: ESS3.B, ETS1.A; CCC: Cause/Effect) Alignment may include 3-5-ETS1-1

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

3-5-ETS1-1	Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost. Alignment may include 3-PS2-4; 3-LS4-4; 3-ESS3-1; 4-PS3-4
3-5-ETS1-2	Generate and compare multiple solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. Alignment may include 4-ESS3-2
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. Alignment may include 4-PS4-3

4th Grade Science

Physical Science

Core Ideas

PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces
- PS3.D: Energy in Chemical Processes and Everyday Life

PS4: Waves and Their Applications in Technologies for Information Transfer

- PS4.A: Wave Properties
- PS4.B: Electromagnetic Radiation
- PS4.C: Information Technologies and Instrumentation

4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object. (SEP: 6; DCI: PS3.A; CCC: Energy/Matter)
4-PS3-2	Make observations to provide evidence for how energy can be transferred from place to place by sound, light, heat, and electric currents. (SEP: 3; DCI: PS3.A, PS3.B; CCC: Energy/Matter)
4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide. (SEP: 1; DCI: PS3.A, PS3.B, PS3.C; CCC: Energy/Matter)
4-PS3-4	Design, test, and refine a device that converts energy from one form to another. (SEP: 6; DCI: PS3.B, PS3.D, ETS1.A; CCC: Energy/Matter) Alignment my include 3-5-ETS1-1
4-PS4-1	Develop a model of waves to describe patterns in terms of amplitude and wavelength and to provide evidence that waves can cause objects to move. (SEP: 2; DCI: PS4.A; CCC: Patterns)
4-PS4-2	Develop a model to describe how light reflecting from objects and entering the eye allows objects to be seen. (SEP: 2; DCI: PS4.B; CCC: Cause/Effect)
4-PS4-3	Create and compare multiple solutions that use patterns to transfer information. (SEP: 6; DCI: PS4.C, ETS1.C; CCC: Patterns) Alignment may include 3-5-ETS1-3

Life Science

Core Ideas

LS1: From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function

LS1.D: Information Processing

4-LS1-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (SEP: 7; DCI: LS1.A; CCC: Systems)
4-LS1-2	Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. (SEP: 2; DCI: LS1.D; CCC: Systems)

Earth and Space Science

Core Ideas

ESS1: Earth's Place in the Universe

ESS1.B: Earth and the Solar System

ESS1.C: The History of Planet Earth

ESS2: Earth's Systems

ESS2.A: Earth Materials and Systems

ESS2.B: Plate Tectonics and Large-Scale System Interactions

ESS2.E: Biogeology

ESS3: Earth and Human Activity

ESS3.A: Natural Resources

ESS3.B: Natural Hazards

4-ESS1-1	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (SEP: 6; DCI: ESS1.C; CCC: Patterns)
4-ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (SEP: 3; DCI: ESS2.A, ESS2.E; CCC: Cause/Effect)
4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features. (SEP: 4; DCI: ESS2.B; CCC: Patterns)
4-ESS3-1	Obtain and combine information to describe that energy and fuels are derived from natural resources and how their uses affect the environment. (SEP: 8; DCI: ESS3.A; CCC: Cause/Effect)
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (SEP: 6; DCI: ESS3.B, ETS1.B; CCC: Cause/Effect) Alignment may include 3-5-ETS1-2

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

ETS1.B: Developing Possible Solutions

ETS1.C: Optimizing the Design Solution

3-5-ETS1-1	Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost. Alignment may include 3-PS2-4; 3-LS4-4; 3-ESS3-1; 4-PS3-4
3-5-ETS1-2	Generate and compare multiple solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. Alignment may include 4-ESS3-2
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. Alignment may include 4-PS4-3

5th Grade Science

Physical Science

Core Ideas

PS1: Matter and Its Interactions

PS1.A: Structure and Properties of Matter

PS1.B: Chemical Reactions

PS2: Motion and Stability: Forces and Interactions

PS2.B: Types of Interactions

PS3: Energy

PS3.D: Energy in Chemical Processes and Everyday Life

5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen. (SEP: 2; DCI: PS1.A; CCC: Scale/Prop.)
5-PS1-2	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total mass of matter is conserved. (SEP: 5; DCI: PS1.A, PS1.B; CCC: Scale/Prop.)
5-PS1-3	Make observations and measurements to identify materials based on their properties. (SEP: 3; DCI: PS1.A; CCC: Scale/Prop.)
5-PS1-4	Plan and carry out an investigation to determine if the mixing of two or more substances results in new substances. (SEP: 3; DCI: PS1.B; CCC: Cause/Effect)
5-PS2-1	Support an evidence-based argument that the gravitational force exerted on objects is directed toward the center of the Earth. (SEP: 7; DCI: PS2.B; CCC: Cause/Effect)
5-PS3-1	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. (SEP: 2; DCI: PS3.D, LSI.C; CCC: Energy/Matter)

Life Science

Core Ideas

LS1: From Molecules to Organisms: Structures and Processes

LS1.C: Organization for Matter and Energy Flow in Organisms

LS2: Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems

5-LS1-1	Engage in an evidence-based argument that plants get the materials they need for growth chiefly from air and water. (SEP: 7; DCI: LS1.C; CCC: Energy/Matter)

5-LS2-1	Develop a model to describe the movement of matter and energy among producers, consumers, decomposers, and the environment. (SEP: 2; DCI: LS2.A, LS2.B; CCC: Systems)

Earth and Space Science

Core Ideas

ESS1: Earth's Place in the Universe

ESS1.A: The Universe and Its Stars

ESS1.B: Earth and the Solar System

ESS2: Earth's Systems

ESS2.A: Earth Materials and Systems

ESS2.C: The Roles of Water in Earth's Surface Processes

ESS3: Earth and Human Activity

ESS3.C: Human Impacts on Earth's Systems

5-ESS1-1	Support an argument that differences in the apparent brightness of the sun compared to other stars is due to distances from the Earth. (SEP: 7; DCI: ESS1.A; CCC: Scale/Prop.)
5-ESS1-2	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (SEP: 4; DCI: ESS1.B; CCC: Patterns)
5-ESS2-1	Develop a model to describe the interaction of geosphere, biosphere, hydrosphere, and atmosphere. (SEP: 2; DCI: ESS2.A; CCC: Systems)
5-ESS2-2	Describe and graph the amounts and percentages of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. (SEP: 5; DCI: ESS2.C; CCC: Scale/Prop.)
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (SEP:8; DCI: ESS3.C; CCC: Systems)

Engineering, Technology, and Applications of Science

Core Idea

ETS1: Engineering Design

3-5-ETS1-1	Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost. Alignment may include 3-PS2-4; 3-LS4-4; 3-ESS3-1; 4-PS3-4
3-5-ETS1-2	Generate and compare multiple solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. Alignment may include 4-ESS3-2

3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. Alignment may include 4-PS4-3

Middle School Science (Grades 6-8)

Physical Science

Core Ideas

PS1: Matter and Its Interactions
- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions

PS2: Motion and Stability: Forces and Interactions
- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

PS3: Energy
- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces

PS4: Waves and Their Applications in Technologies for Information Transfer
- PS4.A: Wave Properties
- PS4.B: Electromagnetic Radiation
- PS4.C: Information Technologies and Instrumentation

MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures. (SEP:2; DCI: PS1.A; CCC: Scale/Prop.)
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. (SEP: 8; DCI: PS1.A, PS1.B; CCC: Patterns)
MS-PS1-3	Obtain and evaluate information to describe that synthetic materials come from natural resources and impact society. (SEP: 8; DCI: PS1.A, PS1.B; CCC: Structure/Function)
MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. (SEP:2; DCI: PS1.A, PS3.A; CCC: Cause/Effect)
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. (SEP: 2; DCI: PS1.B; CCC: Energy/Matter)
MS-PS1-6	Design, construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. (SEP: 6; DCI: PS1.B, ETS1.B, ETS1.C; CCC: Energy/Matter) Alignment may include MS-ETS1-2; MS-ETS1-3; MS-ETS1-4
MS-PS2-1	Design a solution to a problem involving the motion of two colliding objects that illustrates Newton's Third Law. (SEP: 6; DCI: PS2.A, ETS1.B; CCC: Systems) Alignment may include MS-ETS1-1

MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (SEP: 3; DCI: PS2.A; CCC: Stability/Change)
MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (SEP: 1; DCI: PS2.B; CCC: Cause/Effect)
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (SEP:7; DCI: PS2.B; CCC: Systems)
MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other when objects are not in contact. (SEP:3; DCI: PS2.B; CCC: Cause/Effect)
MS-PS3-1	Construct and analyze graphical displays of data to describe the relationships of kinetic energy to the mass and to the speed of an object. (SEP:4; DCI: PS3.A; CCC: Scale/Prop.)
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (SEP:2; DCI: PS3.A, PS3.C; CCC: Systems)
MS-PS3-3	Design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (SEP: 6; DCI: PS3.A, PS3.B, ETS1.A, ETS1.B; CCC: Energy/Matter) May include alignment to MS-ETS1-1 and MS-ETS1-2
MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (SEP:3; DCI: PS3.A, PS3.B; CCC: Scale/Prop.)
MS-PS3-5	Engage in argument from evidence to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (SEP: 7; DCI: PS3.B; CCC: Energy/Matter)
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. (SEP: 5; DCI: PS4.A; CCC: Patterns)
MS-PS4-2	Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials. (SEP:2; DCI: PS4.A, PS4.B; CCC: Structure and Function)
MS-PS4-3	Obtain, evaluate and communicate information to support an evidence-based claim for the reliability of digitized signals to encode and transmit information compared to analog signals. (SEP: 8; DCI: PS4.C; CCC: Structure and Function)

Life Science

Core Ideas

LS1: From Molecules to Organisms: Structures and Processes
- LS1.A: Structure and Function
- LS1.B: Growth and Development of Organisms
- LS1.C: Organization for Matter and Energy Flow in Organisms

LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS3: Heredity: Inheritance and Variation of Traits
- LS3.A: Inheritance of Traits
- LS3.B: Variation of Traits

LS4: Biological Unity and Diversity
- LS4.A: Evidence of Common Ancestry and Diversity
- LS4.B: Natural Selection
- LS4.C: Adaptation
- LS4.D: Biodiversity and Humans

MS-LS1-1	Plan and carry out an investigation to provide evidence that living things are made of cells; either one cell or many different types and numbers of cells. (SEP: 3; DCI: LS1.A; CCC: Scale/Prop)
MS-LS1-2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. (SEP: 2; DCI: LS1.A; CCC: Structure/Function)
MS-LS1-3	Construct an evidence-based argument for how the body is a system of interacting subsystems composed of groups of cells, tissues, and organs. (SEP: 7; DCI: LS1.A; CCC: Systems)
MS-LS1-4	Construct an evidence-based argument to support an explanation for a) how characteristic animal behaviors affect the probability of successful reproduction of animals; and b) how specialized structures affect the probability of successful reproduction of plants. (SEP: 7; DCI: LS1.B; CCC: Cause/Effect)
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (SEP: 6; DCI: LS1.B; CCC: Cause/Effect)
MS-LS1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (SEP: 6, Nature Science/Empirical Evidence; DCI: LS1.C, PS3.D; CCC: Energy/Matter)
MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. (SEP: 2; DCI: LS1.C, PS3.D; CCC: Energy/Matter)

MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (SEP: 4; DCI: LS2.A; CCC: Cause/Effect)
MS-LS2-2	Construct an explanation that predicts patterns (relationships) of interactions among organisms across multiple ecosystems. (SEP: 6; DCI: LS2.A; CCC: Patterns)
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (SEP: 2; DCI: LS2.B; CCC: Energy/Matter)
MS-LS2-4	Construct an evidence-based argument that articulates how changes to physical or biological components of an ecosystem affect populations. (SEP: 7; DCI: LS2.C; CCC: Stability/Change)
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem preservation practices and services. (SEP: 7; DCI: LS2.C, LS4.D, ETS1.B; CCC: Stability/Change) Alignment may include MS-ETS1-2
MS-LS3-1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. (SEP:2; DCI: LS3.A, LS3.B; CCC: Structure/Function)
MS-LS3-2	Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. (SEP: 2; DCI: LS1.B, LS3.A, LS3.B; CCC: Cause/Effect)
MS-LS4-1	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth. (SEP: 4; DCI: LS4.A; CCC: Patterns)
MS-LS4-2	Apply scientific ideas to construct an explanation for similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. (SEP: 6; DCI: LS4.A; CCC: Patterns)
MS-LS4-4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. (SEP: 6; DCI: LS4.B; CCC: Cause/Effect)
MS-LS4-5	Obtain, evaluate, and communicate information about how technological advances have changed the way humans influence the inheritance of desired traits in organisms. (SEP: 8; DCI: LS4.B, CCC: Cause/Effect) Alignment may include MS-ETS1-1, MS-ETS1-4
MS-LS4-6	Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (SEP: 5; DCI: LS4.C; CCC: Cause/Effect)

Earth and Space Science

Core Ideas

ESS1: Earth's Place in the Universe

- ESS1.A: The Universe and Its Stars
- ESS1.B: Earth and the Solar System
- ESS1.C: The History of Planet Earth

ESS2: Earth's Systems

- ESS2.A: Earth Materials and Systems
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.C: The Roles of Water in Earth's Surface Processes
- ESS2.D: Weather and Climate

ESS3: Earth and Human Activity

- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth's Systems
- ESS3.D: Global Climate Change

MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. (SEP: 2; DCI: ESS1.A, ESS1.B; CCC: Patterns)
MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (SEP: 2; DCI: ESS1.A, ESS1.B; CCC: Systems)
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system. (SEP: 4; DCI: ESS1.B; CCC: Scale/Prop.)
MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. (SEP:6; DCI: ESS1.C; CCC: Scale/Prop.)
MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (SEP: 2; DCI: ESS2.A; CCC: Stability/Change)
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (SEP: 6; DCI: ESS2.A, ESS2.C; CCC: Scale/Prop.)
MS-ESS2-3	Analyze and interpret data on the age of the Earth, distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. (SEP: 4; DCI: ESS2.B, ESS1.C; CCC: Patterns)
MS-ESS2-4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (SEP: 2; DCI: ESS2.C; CCC: Energy/Matter)

MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. (SEP: 3; DCI: ESS2.C, ESS2.D; CCC: Cause/Effect)
MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. (SEP: 2; DCI: ESS2.C, ESS2.D; CCC: Systems)
MS-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. (SEP: 6; DCI: ESS3.A; CCC: Cause/Effect)
MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (SEP: 4; DCI: ESS3.B; CCC: Patterns)
MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (SEP: 6; DCI: ESS3.C, ETS1.B; CCC: Cause/Effect) Alignment may include MS-ETS1-1
MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per- capita consumption of natural resources impact Earth's systems. (SEP: 7; DCI: ESS3.C; CCC: Cause/Effect, Nature Science/Consequence-Actions)
MS-ESS3-5	Ask questions to clarify evidence of the factors that may have caused a change in global temperatures over the past century. (SEP: 1; DCI: ESS3.D; CCC: Stability/Change)

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

ETS1.B: Developing Possible Solutions

ETS1.C: Optimizing the Design Solution

MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. Alignment may include MS-PS2-1; MS-PS3-3; MS-LS4-5
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. Alignment may include 6-8-PS1-6; MS-PS3-3; MS-LS2-5; MS-ESS3-3
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. Alignment may include MS-PS1-6

MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. Alignment may include MS-PS1-6; MS-LS4-5

High School Science (Grades 9-12)

Physical Science

Core Ideas

PS1: Matter and Its Interactions
- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions
- PS1.C: Nuclear Processes

PS2: Motion and Stability: Forces and Interactions
- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

PS3: Energy
- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces
- PS3.D: Energy in Chemical Processes and Everyday Life

PS4: Waves and Their Applications in Technologies for Information Transfer
- PS4.A: Wave Properties
- PS4.B: Electromagnetic Radiation
- PS4.C: Information Technologies and Instrumentation

HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (SEP: 2; DCI: PS1.A, PS2.B; CCC: Patterns)
HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (SEP: 6; DCI: PS1.A, PS1.B; CCC: Patterns)
HS-PS1-3	Plan and carry out an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. (SEP: 3; DCI: PS1.A, PS2.B; CCC: Patterns)
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. (SEP: 2; DCI: PS1.A, PS1.B; CCC: Energy/Matter)
HS-PS1-5	Construct an explanation based on evidence about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. (SEP: 6; DCI: PS1.B; CCC: Patterns)
HS-PS1-6	Refine the design of a chemical reaction system by specifying a change in conditions that would produce increased amounts of products at equilibrium. (SEP: 6; DCI: PS1.B, ETS1.C; CCC: Stability/Change) Alignment may include HS-ETS1-3

HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (SEP: 5; DCI: PS1.B; CCC: Energy/Matter, Nature of Science/Consistency)
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. (SEP: 2; DCI: PS1.C; CCC: Energy/Matter)
HS-PS2-1	Analyze data to support the claim that Newton's Second Law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. (SEP: 4; DCI: PS2.A; CCC: Cause/Effect)
HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. (SEP: 5; DCI: PS2.A; CCC: Systems)
HS-PS2-3	Design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. (SEP: 6; DCI: PS2.A, ETS1.A, ETS1.C; CCC: Cause/Effect) Alignment may include HS-ETS1-1, HS-ETS1-3
HS-PS2-4	a) Use mathematical representations of Newton's Law of Gravitation to describe and predict the gravitational forces between objects; and b) Use mathematical representations of Coulomb's Law to describe and predict electrostatic force between objects. (SEP: 5; DCI: PS2.B; CCC: Patterns)
HS-PS2-5	Plan and carry out an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. (SEP: 3; DCI: PS2.B, PS3.A; CCC: Cause/Effect)
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure (intermolecular forces) is important in the functioning of designed materials. (SEP: 8; DCI: PS1.A, PS2.B, ETS1.A; CCC: Structure/Function) Alignment may include HS-ETS1-1
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (SEP: 5; DCI: PS3.A, PS3.B; CCC: Systems)
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion and relative position of particles (objects). (SEP: 2; DCI: PS3.A; CCC: Energy/Matter)
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (SEP: 6; DCI: PS3.A, PS3.D, ETS1.A; CCC: Energy/Matter) Alignment may include HS-ETS1-2
HS-PS3-4	Plan and carry out an investigation to provide evidence for the Second Law of Thermodynamics. (SEP: 3; DCI: PS3.B, PS3.D; CCC: Systems)

HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. (SEP: 2; DCI: PS3.C; CCC: Cause/Effect)
HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. (SEP: 5; DCI: PS4.A; CCC: Cause/Effect)
HS-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information. (SEP: 1; DCI: PS4.A; CCC: Stability/Change) Alignment may include HS-ETS1-1
HS-PS4-3	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. (SEP: 7; DCI: PS4.A, PS4.B; CCC: Systems)
HS-PS4-4	Engage in an evidence-based argument for the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (SEP: 7; DCI: PS4.B; CCC: Cause/Effect)
HS-PS4-5	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. (SEP: 8; DCI: PS3.D, PS4.A, PS4.B, PS4.C, ETS1.A; CCC: Cause/Effect) Alignment may include HS-ETS1-1

Life Science

Core Ideas

LS1: From Molecules to Organisms: Structures and Processes
- LS1.A: Structure and Function
- LS1.B: Growth and Development of Organisms
- LS1.C: Organization for Matter and Energy Flow in Organisms

LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- LS2.D: Social Interactions and Group Behavior

LS3: Heredity: Inheritance and Variation of Traits
- LS3.A: Inheritance of Traits
- LS3.B: Variation of Traits

LS4: Biological Unity and Diversity
- LS4.A: Evidence of Common Ancestry and Diversity
- LS4.B: Natural Selection
- LS4.C: Adaptation
- LS4.D: Biodiversity and Humans

HS-LS1-1	Construct an evidence-based explanation for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells, tissues, and organs. (SEP: 6; DCI: LS1.A; CCC: Structure/Function)
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. (SEP: 2; DCI: LS1.A; CCC: Systems)
HS-LS1-3	Plan and carry out an investigation to provide evidence that feedback mechanisms maintain homeostasis. (SEP: 3; DCI: LS1.A; CCC: Stability/Change)
HS-LS1-4	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. (SEP: 2; DCI: LS1.B; CCC: Systems)
HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. (SEP: 2; DCI: LS1.C; CCC: Systems, Energy/Matter)
HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. (SEP: 6; DCI: LS1.C; CCC: Energy/Matter)
HS-LS1-7	Use a model of the major inputs and outputs of cellular respiration (aerobic and anaerobic) to exemplify the chemical process in which the bonds of food molecules are broken, the bonds of new compounds are formed, and a net transfer of energy results. (SEP: 2; DCI: LS1.C; CCC: Energy/Matter)
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. (SEP: 5; DCI: LS2.A; CCC: Scale/Prop.)
HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. (SEP: 5; DCI: LS2.A, LS2.C; CCC: Scale/Prop.)
HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. (SEP:6; DCI: LS2.B; CCC: Energy/Matter)
HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (SEP: 5; DCI: LS2.B; CCC: Energy/Matter)
HS-LS2-5	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (SEP: 2; DCI: LS2.B, PS3.D; CCC: Systems)
HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms under stable conditions; however, moderate to extreme fluctuations in conditions may result in new ecosystems. (SEP: 7; DCI: LS2.C; CCC: Stability/Change)

HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. (SEP: 6; DCI: LS2.C, LS4.D, ETS1.B, ETS1.C; CCC: Stability/Change) Alignment may include HS-ETS1-2 and HS-ETS1-3
HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. (SEP: 7; DCI: LS2.D; CCC: Cause/Effect)
HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. (SEP: 1; DCI: LS1.A, LS3.A; CCC: Cause/Effect)
HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (SEP: 7; DCI: LS3.B; CCC: Cause/Effect)
HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (SEP: 4; DCI: LS3.B; CCC: Scale/Prop.)
HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (SEP: 8; DCI: LS4.A; CCC: Patterns)
HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. (SEP: 6; DCI: LS4.B, LS4.C; CCC: Cause/Effect)
HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. (SEP: 4; DCI: LS4.B, LS4.C; CCC: Patterns)
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations. (SEP: 6; DCI: LS4.C; CCC: Cause/Effect)
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. (SEP: 7; DCI: LS4.C; CCC: Cause/Effect)
HS-LS4-6	Use a simulation to research and analyze possible solutions for the adverse impacts of human activity on biodiversity. (SEP: 5; DCI: LS4.C, LS4.D, ETS1.B; CCC: Cause/Effect) Alignment may include HS-ETS1-3, HS-ETS1-4

Earth and Space Science

Core Ideas

ESS1: Earth's Place in the Universe

- ESS1.A: The Universe and Its Stars
- ESS1.B: Earth and the Solar System
- ESS1.C: The History of Planet Earth

ESS2: Earth's Systems

- ESS2.A: Earth Materials and Systems
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.D: Weather and Climate

ESS3: Earth and Human Activity

- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth's Systems
- ESS3.D: Global Climate Change

HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. (SEP: 2; DCI: ESS1.A, PS3.D; CCC: Scale/Prop.)
HS-ESS1-2	Construct an explanation of the Big Bang Theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. (SEP: 6; DCI: PS4.B, ESS1.A; CCC: Energy/Matter)
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements. (SEP: 8; DCI: ESS1.A; CCC: Energy/Matter)
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. (SEP: 5; DCI: ESS1.B; CCC: Scale/Prop.)
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. (SEP: 7; DCI: ESS1.C, ESS2.B, PS1.C; CCC: Patterns)
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. (SEP: 6; DCI: ESS1.C, PS1.C; CCC: Stability/Change)
HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. (SEP:2; DCI: ESS2.B; CCC: Stability/Change)
HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that cause changes to other Earth systems. (SEP: 2; DCI: ESS2.A, ESS2.B; CCC: Stability/Change)

HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. (SEP: 4; DCI: ESS2.A, ESS2.D; CCC: Stability/Change)
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. (SEP: 2; DCI: ESS2.A, ESS2.B, PS4.A; CCC: Energy/Matter)
HS-ESS2-5	Plan and carry out an investigation of the properties of water and its effects on Earth's materials and surface processes. (SEP: 2; DCI: ESS1.B, ESS2.A, ESS2.D; CCC: Cause/Effect)
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. (SEP: 6; DCI: ESS3.A, ESS3.B; CCC: Cause/Effect)
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. (SEP: 7; DCI: ESS3.A, ETS1.B; CCC: Energy and Matter) Alignment may include HS-ETS1-3
HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. (SEP: 5; DCI: ESS3.C; CCC: Stability/Change)
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. (SEP: 6; DCI: ESS3.C, ETS1.B; CCC: Stability/Change) Alignment may include HS-ETS1-3
HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. (SEP: 4; DCI: ESS3.D; CCC: Stability/Change)
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. (SEP: 5; DCI: ESS2.D, ESS3.D; CCC: Systems)

Engineering, Technology, and Applications of Science

Core Ideas

ETS1: Engineering Design

- ETS1.A: Defining and Delimiting an Engineering Problem
- ETS1.B: Developing Possible Solutions
- ETS1.C: Optimizing the Design Solution

HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria for constraints for solutions that account for societal needs and wants. Alignment may include HS-PS2-3; HS-PS2-6; HS-PS4-2; HS-PS4-5

HS-ETS1-2	Design a solution to complex real-world problems by breaking it down into smaller, more manageable problems that can be solved through engineering. Alignment may include HS-LS2-7; HS-PS3-3
HS-ETS1-3	Evaluate a solution to a complex real-word problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as social, cultural, and environmental impacts. Alignment may include HS-PS1-6; HS-PS2-3; HS-LS2-7; HS-LS4-6; HS-ESS3-2; HS-ESS3-4
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. Alignment may include HS-LS4-6