

NEXT GENERATION SCIENCE STANDARDS (NGSS)

| GRADE | LIFE SCIENCE | EARTH AND SPACE SCIENCE | PHYSICAL SCIENCE |
|--|---|--|--|
| 1 | <u>Structure, Function and Information Processing</u> | <u>Space Systems: Patterns and Cycles</u> | <u>Waves: Light and Sound</u> |
| 2 | <u>Interdependent Relationships in Ecosystems</u> | <u>Earth's Systems: Processes That Shape the Earth</u> | <u>Structure and Properties of Matter</u> |
| 3 | <u>Interdependent Relationships in Ecosystems</u> <u>Inheritance and Variation of Traits</u> | <u>Weather and Climate</u> | <u>Forces and Interactions</u> |
| 4 | <u>Structure, Function, and Information Processing</u> | <u>Earth's Systems: Processes That Shape the Earth</u> | <u>Energy</u> <u>Waves: Waves and Information</u> |
| 5 | <u>Matter and Energy in Organisms and Ecosystems</u> | <u>5. Earth's Systems</u> <u>5. Space Systems: Stars and the Solar System</u> | <u>Structure and Properties of Matter</u> |
| <u>Grades K-2 Engineering Design Introduction</u> <u>K-2. Engineering Design</u> <u>Grades 3-5 Engineering Design Introduction</u> <u>3-5. Engineering Design</u> | | | |

NEXT GENERATION SCIENCE STANDARDS (NGSS)

GRADE 1:

LIFE SCIENCE:

Structure, Function and Information Processing

LS1.A: Structure and Function

- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)

LS1.B: Growth and Development of Organisms

- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)

LS1.D: Information Processing

- Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)

LS3.A: Inheritance of Traits

- Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents. (1-LS3-1)

LS3.B: Variation of Traits

- Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways. (1-LS3-1)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

EARTH AND SPACE SCIENCE

Space Systems: Patterns and Cycles

ESS1.A: The Universe and Its Stars

- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1-ESS1-1)

ESS1.B: Earth and the Solar System

- Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1-ESS1-2)

PHYSICAL SCIENCE

Waves: Light and Sound

PS4.A: Wave Properties

- Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1)

PS4.B: Electromagnetic Radiation

- Objects can be seen if light is available to illuminate them or if they give off their own light. (1-PS4-2)
- Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) (1-PS4-3)

PS4.C: Information Technologies and Instrumentation

- People also use a variety of devices to communicate (send and receive information) over long distances. (1-PS4-4)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

GRADE 2:

LIFE SCIENCE:

Interdependent Relationships in Ecosystems

LS2.A: Interdependent Relationships in Ecosystems

- Plants depend on water and light to grow. (2-LS2-1)
- Plants depend on animals for pollination or to move their seeds around. (2-LS2-2)

LS4.D: Biodiversity and Humans

- There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (*secondary to 2-LS2-2*)

EARTH AND SPACE SCIENCE

Earth's Systems: Processes That Shape the Earth

ESS1.C: The History of Planet Earth

- Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2-ESS1-1)

ESS2.A: Earth Materials and Systems

- Wind and water can change the shape of the land. (2-ESS2-1)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

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

- Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2-2)

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

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (*secondary to 2-ESS2-1*)

PHYSICAL SCIENCE

Structure and Properties of Matter

PS1.A: Structure and Properties of Matter

- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- Different properties are suited to different purposes. (2-PS1-2), (2-PS1-3)
- A great variety of objects can be built up from a small set of pieces. (2-PS1-3)

PS1.B: Chemical Reactions

- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Grades K-2 Engineering Design

ETS1.A: Defining and Delimiting Engineering Problems

- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (K-2-ETS1-1)
- Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)
- Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

GRADE 3

LIFE SCIENCE:

1. Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. *(secondary to 3-LS4-4)*

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (3-LS2-1)

LS4.A: Evidence of Common Ancestry and Diversity

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (3-LS4-1)
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

2. Inheritance and Variation of Traits

LS1.B: Growth and Development of Organisms

- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

LS3.A: Inheritance of Traits

- Many characteristics of organisms are inherited from their parents. (3-LS3-1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

LS3.B: Variation of Traits

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

LS4.B: Natural Selection

- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

EARTH AND SPACE SCIENCE

Weather and Climate

ESS2.D: Weather and Climate

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)

ESS3.B: Natural Hazards

- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

PHYSICAL SCIENCE

Forces and Interactions

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative additions of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3), (3-PS2-4)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

GRADE 4

LIFE SCIENCE:

Structure, Function, and Information Processing

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

LS1.D: Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

EARTH AND SPACE SCIENCE

Earth's Systems: Processes That Shape the Earth

ESS1.C: The History of Planet Earth

- Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

ESS2.A: Earth Materials and Systems

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)

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

- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2)

ESS2.E: Biogeology

- Living things affect the physical characteristics of their regions. (4-ESS2-1)

ESS3.B: Natural Hazards

- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (4-ESS3-2)

ETS1.B: Developing Solutions to Engineering Problems

- Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

PHYSICAL SCIENCE

1. Energy

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses. (4-PS3-1)
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2), (4-PS3-3)

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2), (4-PS3-3)
- Light also transfers energy from place to place. (4-PS3-2)
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2), (4-PS3-4)

PS3.C: Relationship between Energy and Forces

- When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)

PS3.D: Energy in Chemical Processes and Everyday Life

- The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)

ESS3.A: Natural Resources

- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

ETS1.A: Defining Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary to 4-PS3-4)*

2. Waves: Waves and Information

PS4.A: Wave Properties

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. *(4-PS4-1)*
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). *(4-PS4-1)*

PS4.C: Information Technologies and Instrumentation

- Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. *(4-PS4-3)*

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. *(secondary to 4-PS-3)*

NEXT GENERATION SCIENCE STANDARDS (NGSS)

GRADE 5

LIFE SCIENCE:

Matter and Energy in Organisms and Ecosystems

PS3.D: Energy in Chemical Processes and Everyday Life

- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1)

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

- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (*secondary to 5-PS3-1*)
- Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

LS2.A: Interdependent Relationships in Ecosystems

- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

- Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

EARTH AND SPACE SCIENCE

1. Earth's Systems

ESS2.A: Earth Materials and Systems

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)

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

- Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2)

ESS3.C: Human Impacts on Earth Systems

- Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

2. Space Systems: Stars and the Solar System

PS2.B: Types of Interactions

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)

ESS1.A: The Universe and Its Stars

- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5-ESS1-1)

ESS1.B: Earth and the Solar System

NEXT GENERATION SCIENCE STANDARDS (NGSS)

- The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (5-ESS1-2)

PHYSICAL SCIENCE

Structure and Properties of Matter

PS1.A: Structure and Properties of Matter

- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1)
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)
- Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)

PS1.B: Chemical Reactions

- When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)
- No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Grades 3-5 Engineering Design

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)