

Alaska Agriculture in the Classroom – Indoor Gardening Curriculum Science Standards – Definitions & Corresponding Disciplinary Core Ideas

Kindergarten		
Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	K-LS1-1 Use observations to describe patterns of what plants and animals (including humans) need to survive.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.
	K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	ESS3.A: Natural Resources <ul style="list-style-type: none"> Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.
	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.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> 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.
Next Generation Science Standards (NGSS)	K-LS1-1 Use observations to describe patterns of what plants and animals (including humans) need to survive.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.
	K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.	ESS2.E: Biogeology <ul style="list-style-type: none"> Plants and animals can change their environment.
	K-ESS3-1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.	ESS3.A: Natural Resources <ul style="list-style-type: none"> Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.
	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.	ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem.
	K-2-ETS1-3 Analyze data from tests of two objects designed to solve	ETS1.C: Optimizing the Design Solution <ul style="list-style-type: none"> Because there is always more than one possible solution to a problem, it is useful to

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	the same problem to compare the strengths and weaknesses of how each performs.	compare and test designs.
Grade 1		
Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	1-LS1-1 Use materials to 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.	LS1.A: Structure and Function <ul style="list-style-type: none"> 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. LS1.D: Information Processing <ul style="list-style-type: none"> 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.
	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.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> 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.
Next Generation Science Standards (NGSS)	1-LS1-1 Use materials to 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.	LS1.A: Structure and Function <ul style="list-style-type: none"> 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. LS1.D: Information Processing <ul style="list-style-type: none"> 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-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	LS1.B: Growth and Development of Organisms <ul style="list-style-type: none"> 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-ESS1-2 Make observations at different times of year to relate the amount of daylight to the time of year.	ESS1.B: Earth and the Solar System <ul style="list-style-type: none"> Seasonal patterns of sunrise and sunset can be observed, described, and predicted.
	K-2-ETS1-1	ETS1.A: Defining and Delimiting Engineering Problems

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	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.	<ul style="list-style-type: none"> • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem.
Grade 2		
Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	2-LS2-1 Plan and conduct an investigation to determine if plants need sunlight and water to grow.	LS2.A: Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> • Plants depend on water and light to grow.
	2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.	LS4.D: Biodiversity and Humans <ul style="list-style-type: none"> • There are many different kinds of living things in any area, and they exist in different places on land and in water.
	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.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • 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.
	2-PS1-4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	PS1.B: Chemical Reactions <ul style="list-style-type: none"> • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.
Next Generation Science Standards (NGSS)	2-LS2-1 Plan and conduct an investigation to determine if plants need sunlight and water to grow.	LS2.A: Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> • Plants depend on water and light to grow.
	2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.	LS4.D: Biodiversity and Humans <ul style="list-style-type: none"> • There are many different kinds of living things in any area, and they exist in different places on land and in water.
	2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	PS1.A: Structure and Properties of Matter <ul style="list-style-type: none"> • 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-PS1-2 Analyze data obtained from testing different materials to	PS1.A: Structure and Properties of Matter <ul style="list-style-type: none"> • Different properties are suited to different purposes.

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	determine which materials have the properties that are best suited for an intended purpose.	
	2-PS1-4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	PS1.B: Chemical Reactions <ul style="list-style-type: none"> • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.
	2-ESS2-2 Develop a model to represent the shapes and kinds of land and bodies of water in an area.	ESS2.B: Plate Tectonics and Large-Scale System Interactions <ul style="list-style-type: none"> • Maps show where things are located. One can map the shapes and kinds of land and water in any area.
	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.	ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem.
	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.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • 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-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	ETS1.C: Optimizing the Design Solution <ul style="list-style-type: none"> • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Grade 3

Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment.	LS3.A: Inheritance of Traits <ul style="list-style-type: none"> • Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. LS3.B: Variation of Traits <ul style="list-style-type: none"> • The environment also affects the traits that an organism develops.
	3-LS4-3 Construct an argument with evidence that in a particular	LS4.C: Adaptation <ul style="list-style-type: none"> • For any particular environment, some kinds of organisms survive well, some survive

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	<p>habitat some organisms can survive well, some survive less well, and some cannot survive at all.</p>	<p>less well, and some cannot survive at all.</p>
	<p>3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> 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. <p>LS4.D: Biodiversity and Humans</p> <ul style="list-style-type: none"> Populations live in a variety of habitats, and change in those habitats affects the organisms living there.
	<p>3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> 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.
	<p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> 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. 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.
	<p>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.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> Tests are often designed to identify failure points or difficulties which suggest the elements of a design that need to be improved. <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
<p>Next Generation Science Standards (NGSS)</p>	<p>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.</p>	<p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.
	<p>3-LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.</p>	<p>LS3.A: Inheritance of Traits</p> <ul style="list-style-type: none"> Many characteristics of organisms are inherited from their parents. <p>LS3.B: Variation of Traits</p>

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		<ul style="list-style-type: none"> Different organisms vary in how they look and function because they have different inherited information.
3-LS3-2	Use evidence to support the explanation that traits can be influenced by the environment.	LS3.A: Inheritance of Traits <ul style="list-style-type: none"> Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.
3-LS4-3	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	LS4.C: Adaptation <ul style="list-style-type: none"> For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.
3-LS4-4	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	LS4.D: Biodiversity and Humans <ul style="list-style-type: none"> Populations live in a variety of habitats, and change in those habitats affects the organisms living there. LS2.C: Ecosystem Dynamics, Functioning, and Resilience <ul style="list-style-type: none"> 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.
3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> 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.

Grade 4

Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	LS1.A: Structure and Function <ul style="list-style-type: none"> Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
	4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the	LS1.D: Information Processing <ul style="list-style-type: none"> 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

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	information in their brain, and respond to the information in different ways.	memories to guide their actions.
	<p>4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.</p>	<p>PS3.B: Conservation of Energy and Energy Transfer</p> <ul style="list-style-type: none"> 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. <p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.
	<p>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.</p>	<p>ESS2.A: Earth Materials and Systems</p> <ul style="list-style-type: none"> 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. <p>ESS2.E: Biogeology</p> <ul style="list-style-type: none"> Living things affect the physical characteristics of their regions.
	<p>3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> 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.
	<p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> 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. 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.
	<p>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.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> Tests are often designed to identify failure points or difficulties which suggest the elements of a design that need to be improved. <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
Next Generation	<p>4-LS1-1 Construct an argument that plants and animals have</p>	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> Plants and animals have both internal and external structures that serve various

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Science Standards (NGSS)	internal and external structures that function to support survival, growth, behavior, and reproduction.	functions in growth, survival, behavior, and reproduction.
	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.	LS1.D: Information Processing <ul style="list-style-type: none"> 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-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth’s features.	ESS2.A: Earth Materials and Systems <ul style="list-style-type: none"> 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. ESS2.E: Biogeology <ul style="list-style-type: none"> Living things affect the physical characteristics of their regions.
	3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> 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-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> 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. 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.

Grade 5

Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> Plants acquire their material for growth chiefly from air and water.
	5-LS2-1 Develop and describe a model that describes the movement of matter among plants, animals, decomposers, and the	LS2.A: Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> 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

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	<p>environment.</p>	<p>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.</p> <p>LS2.B: Cycles of Matter and Energy Transfer in Ecosystems</p> <ul style="list-style-type: none"> • 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.
	<p>5-PS3-1 Use models to describe that energy in animals’ food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams, and flow charts.]</p>	<p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> • 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).
	<p>3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> • 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.
	<p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • 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. • 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.
	<p>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.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • Tests are often designed to identify failure points or difficulties which suggest the elements of a design that need to be improved. <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
<p>Next Generation Science</p>	<p>5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water.</p>	<p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> • Plants acquire their material for growth chiefly from air and water.

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Standards (NGSS)	5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	LS2.A: Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> • 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. LS2.B: Cycles of Matter and Energy Transfer in Ecosystems <ul style="list-style-type: none"> • 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-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.	PS3.D: Energy in Chemical Processes and Everyday Life <ul style="list-style-type: none"> • 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-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.	ESS3.C: Human Impacts on Earth Systems <ul style="list-style-type: none"> • 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.
	3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> • 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-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • 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. • 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.

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Middle School (Grades 6-8)		
Standard	Definition	Corresponding Disciplinary Core Idea
Science Standards for Alaska	MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	LS1.A: Structure and Function <ul style="list-style-type: none"> All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).
	MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.	LS1.A: Structure and Function <ul style="list-style-type: none"> Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.
	MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	LS1.A: Structure and Function <ul style="list-style-type: none"> In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.
	MS-LS1-4 Use an evidence-based argument to support an explanation for how characteristic behaviors and/or structures of organisms affect the probability of their successful reproduction.	LS1.B: Growth and Development of Organisms <ul style="list-style-type: none"> Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
	MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	LS1.B: Growth and Development of Organisms <ul style="list-style-type: none"> Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. Genetic factors as well as local conditions affect the growth of the adult plant.
	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.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.
	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.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.

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<p>MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.</p>	<p>LS1.D: Information Processing</p> <ul style="list-style-type: none"> Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.
<p>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.</p>	<p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Growth of organisms and population increases are limited by access to resources.
<p>MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.</p>	<p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
<p>MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</p>	<p>LS2.B: Cycle of Matter and Energy Transfer in Ecosystems</p> <ul style="list-style-type: none"> Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.
<p>MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
<p>MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health
<p>MS-ESS3-2</p>	<p>ESS3.B: Natural Hazards</p>

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	<p>Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.</p>	<ul style="list-style-type: none"> Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.
	<p>MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.</p>	<p>ESS3.C: Human Impacts on Earth Systems</p> <ul style="list-style-type: none"> Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.
	<p>MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.</p>	<p>ESS3.D: Global Climate Change</p> <ul style="list-style-type: none"> Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.
	<p>MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge likely to limit possible solutions.
	<p>MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
	<p>MS-ETS1-4 Develop a model to generate data for repetitive testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. Models of all kinds are important for testing solutions. <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.
<p>Next Generation</p>	<p>MS-LS1-1 Conduct an investigation to provide evidence that living</p>	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> All living things are made up of cells, which is the smallest unit that can be said to be

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Science Standards (NGSS)	things are made of cells; either one cell or many different numbers and types of cells.	alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).
	MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.	LS1.A: Structure and Function <ul style="list-style-type: none"> • Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.
	MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	LS1.B: Growth and Development of Organisms <ul style="list-style-type: none"> • Genetic factors as well as local conditions affect the growth of the adult plant.
	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.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> • Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.
	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.	Cross-Cutting Concept: Energy and Matter <ul style="list-style-type: none"> • Matter is conserved because atoms are conserved in physical and chemical processes.
	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.	LS2.A: Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. • Growth of organisms and population increases are limited by access to resources.
	MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	LS2.A: Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
	MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an	LS2.B: Cycle of Matter and Energy Transfer in Ecosystems <ul style="list-style-type: none"> • Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an

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	ecosystem.	ecosystem. Transfers of matter into and out of the physical environment occur at every level. <ul style="list-style-type: none"> Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.
	MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience <ul style="list-style-type: none"> Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
	MS-LS4-5 Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.	LS4.B: Natural Selection <ul style="list-style-type: none"> In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.
	MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	ESS3.C: Human Impacts on Earth Systems <ul style="list-style-type: none"> Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
	MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	MS-ETS1.A: Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.
	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.	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. Models of all kinds are important for testing solutions. ETS1.C: Optimizing the Design Solution <ul style="list-style-type: none"> The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.

High School (Grades 9-12)

Standard	Definition	Corresponding Disciplinary Core Idea
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Science Standards for Alaska	HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.	LS1.A: Structure and Function <ul style="list-style-type: none"> Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
	HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	LS1.C: Organization for Matter and Energy Flow in Organisms <ul style="list-style-type: none"> The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.
	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.	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems <ul style="list-style-type: none"> Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.
	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.	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems <ul style="list-style-type: none"> Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.
	HS-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience <ul style="list-style-type: none"> A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.
	HS-ESS2-2 Analyze geoscience data to evaluate claims that one change to Earth's surface creates feedbacks that cause changes to other Earth systems.	ESS2.A: Earth Materials and Systems <ul style="list-style-type: none"> Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. ESS2.D: Weather and Climate <ul style="list-style-type: none"> The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.
	HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.	ESS2.D: Weather and Climate <ul style="list-style-type: none"> Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ESS2.E: Biogeology <ul style="list-style-type: none"> The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co- evolution of Earth's surface and the life that exists on it.

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	<p>HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</p>	<p>ESS3.C: Human Impacts on Earth Systems</p> <ul style="list-style-type: none"> Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
<p>Next Generation Science Standards (NGSS)</p>	<p>HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.</p>	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.
	<p>HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.</p>	<p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.
	<p>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.</p>	<p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.
	<p>HS-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.
	<p>HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.
	<p>HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in</p>	<p>LS4.C: Adaptation</p> <ul style="list-style-type: none"> Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and

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	<p>the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</p>	<p>sometimes the extinction—of some species.</p> <ul style="list-style-type: none"> Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
	<p>HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.</p>	<p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.
	<p>HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.</p>	<p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. <p>ESS2.E: Biogeology</p> <ul style="list-style-type: none"> The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.
	<p>HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</p>	<p>ESS3.C: Human Impacts on Earth Systems</p> <ul style="list-style-type: none"> Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
	<p>HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
	<p>HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.</p>	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.