5th Grade - Thematic Model - Bundle 2
Flow and Cycles of Matter and Energy

This is the second bundle of the Fifth Grade Thematic Model. Each bundle has connections to the other bundles in the course, as shown in the Course Flowchart.

Bundle 2 Questions: This bundle is assembled to address the questions "How do animals have energy to move around?"

Summary

The bundle organizes performance expectations with a focus on helping students understand flow and cycles of matter and energy, especially in the context of ecosystems. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, and is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs

The concept that matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die (LS2.B as in 5-LS2-1) connects to the idea that matter of any type can be subdivided into particles that are too small to see (PS1.A as in 5-PS1-1), because matter is subdivided into particles as it flows between organisms and the air and soil. The idea about matter flows also connects to the ideas that plants acquire their material for growth chiefly from air and water (LS1.C as in 5-LS1-1) and that food provides animals with the materials they need for body repair and growth (LS1.C in 5-PS3-1).

Just as matter flows, energy can flow as well. As such, the idea that matter can flow connects to the concept that the energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (PS3.D as in 5-PS3-1).

The concept that matter flows between organisms and the air and soil also indicates interdependence between organisms and their environment. Such interdependence connects to the idea that human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space (ESS3.C as in 5-ESS3-1).

The ideas that cycles of 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 (ESS1.B as in 5-ESS1-2) can connect to the idea that matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die (LS2.B as in 5-LS2-1), but is also included in this bundle to allow students time to collect data on patterns of the sun, moon, and stars throughout the year.

The engineering design concept that solutions to a problem are limited by available materials and resources, or constraints (ETS1.A as in 3-5-ETS1-1) could connect to multiple science concepts, such as that human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space (ESS3.C as in 5-ESS3-1) and that 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 (LS2.A as in 5-LS2-1). The first connection could be made by having students solve a problem – with limited, given resources – related to an effect that humans have on the land. The second could be made through having students create a plan to improve the health of a given ecosystem within given constraints.

Bundle Science and Engineering Practices

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of asking questions and defining problems (3-5-ETS1-1); developing and using models (5-PS1-1, 5-PS3-1, and 5-LS2-1); analyzing and interpreting data (5-ESS1-2); engaging in argument from evidence (5-LS1-1); and obtaining, evaluating, and communicating Information (5-ESS3-1). Many other practice elements can be used in instruction.

Bundle Crosscutting Concepts Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the crosscutting concepts of Patterns (5-ESS1-2); Scale, Proportion, and Quantity (5-PS1-1); Systems and System Models (5-LS2-1 and 5-ESS3-1); and Energy and Matter (5-PS3-1 and 5-LS1-1). Many other crosscutting concepts elements can be used in instruction. *All instruction should be three-dimensional.*	
Performance Expectations 5-PS1-1 and 5-ESS1-2 are partially assessable	5-PS1-1. **Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [*Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.*] 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.** [Clarification Statement: Examples of models could include diagrams, and flow charts.] 5-LS1-1. **Support an argument that plants get the materials they need for growth chiefly from air and water.** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.] 5-LS2-1. **Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.] 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.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [*Assessment Boundary: Assessment does not include causes of seasons.*] 5-ESS3-1. **Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.** 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.**
Example Phenomena	Spiders can regrow legs. Human hair can be analyzed to determine how much of an individuals' diet is corn.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. Students could *ask questions that can be investigated* [about where] ***plants acquire their material for growth***. 5-LS1-1 **Developing and Using Models** • Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events. Students could *collaboratively revise a model based on evidence* [to] *show the relationship* [between] ***plant growth and air***. 5-LS1-1

Additional Practices Building to the PEs (Continued)	**Planning and Carrying Out Investigations** • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. Students could *plan and conduct an investigation collaboratively – using fair tests in which variables are controlled and the number of trials considered – to produce data to serve as the basis for evidence* [that] ***plants acquire their material for growth chiefly from air and water***. 5-LS1-1 **Analyzing and Interpreting Data** • Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. Students could *represent data in various graphical displays to reveal patterns that indicate relationships* [between] ***human activities in everyday life*** [and] ***the land, vegetation, streams, ocean, and air***. 5-ESS3-1 **Using Mathematical and Computational Thinking** • Organize simple data sets to reveal patterns that suggest relationships. Students could *organize simple data sets to reveal patterns* [in the] ***daily changes in the length and direction of shadows***. 5-ESS1-2 **Constructing Explanations and Designing Solutions** • Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. Students could *use evidence to construct an explanation* [that] ***matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists***. 5-PS1-1 **Engaging in Argument from Evidence** • Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions. Students could *respectfully receive critiques from peers about a proposed explanation* [that] ***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 **Obtaining, Evaluating and Communicating Information** • Read and comprehend grade appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence. Students could *read and comprehend grade appropriate complex texts* [about the idea that] ***food provides animals with the materials they need for body repair*** *to summarize and describe how* [this concept is] *supported by evidence.* 5-PS3-1

Additional Crosscutting Concepts Building to the PEs	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. Students could *identify* [the] *cause and effect relationships* [between] ***human activities in industry and*** [effects on] **the air** *and use* [the relationships] *to explain change*. 5-ESS3-1 **Scale, Proportion, and Quantity** • Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods. Students could describe that *observable phenomena exist from the very small*, ***such as fungi and bacteria breaking down dead organisms*** *to the immensely large*, [such as entire] ***environments***. 5-LS2-1 **Energy and Matter** • Matter is made of particles. Students could describe that *matter is made of particles* [in the context that] ***matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die***. 5-LS2-1
Additional Connections to Nature of Science	**Scientific Investigations Use a Variety of Methods** • Science investigations use a variety of methods, tools, and techniques. Students could describe [several different] *methods, tools, and techniques* [they could use to investigate that] ***plants acquire their material for growth chiefly from air and water***. 5-LS1-1 **Scientific Knowledge is Open to Revision in Light of New Evidence** • Science explanations can change based on new evidence. Students could construct explanations of where ***plants acquire their material for growth*** [before and after an investigation and then use this experience as evidence to describe that] *science explanations can change based on new evidence*. 5-LS1-1

5-PS1-1 Matter and Its Interactions

Students who demonstrate understanding can:

5-PS1-1. **Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [*Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Use models to describe phenomena.

Disciplinary Core Ideas

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.

Crosscutting Concepts

Scale, Proportion, and Quantity

- Natural objects exist from the very small to the immensely large.

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students develop a model to describe* a phenomenon that includes the idea that matter is made of particles too small to be seen. In the model, students identify the relevant components for the phenomenon, including:	
		i.	Bulk matter (macroscopic observable matter; e.g., as sugar, air, water).
		ii.	Particles of matter that are too small to be seen.
2	Relationships		
	a	In the model, students identify and describe* relevant relationships between components, including the relationships between:	
		i.	Bulk matter and tiny particles that cannot be seen (e.g., tiny particles of matter that cannot be seen make up bulk matter).
		ii.	The behavior of a collection of many tiny particles of matter and observable phenomena involving bulk matter (e.g., an expanding balloon, evaporating liquids, substances that dissolve in a solvent, effects of wind).
3	Connections		
	a	Students use the model to describe* how matter composed of tiny particles too small to be seen can account for observable phenomena (e.g., air inflating a basketball, ice melting into water).	

5-PS3-1 Energy

Students who demonstrate understanding can:

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.** [Clarification Statement: Examples of models could include diagrams, and flow charts.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Use models to describe phenomena.	**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). **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)*	**Energy and Matter** • Energy can be transferred in various ways and between objects.

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students use models to describe* a phenomenon that includes the idea that energy in animals' food was once energy from the sun. Students identify and describe* the components of the model that are relevant for describing* the phenomenon, including:	
		i.	Energy.
		ii.	The sun.
		iii.	Animals, including their bodily functions (e.g., body repair, growth, motion, body warmth maintenance).
		iv.	Plants.
2	Relationships		
	a	Students identify and describe* the relevant relationships between components, including:	
		i.	The relationship between plants and the energy they get from sunlight to produce food.
		ii.	The relationship between food and the energy and materials that animals require for bodily functions (e.g., body repair, growth, motion, body warmth maintenance).
		iii.	The relationship between animals and the food they eat, which is either other animals or plants (or both), to obtain energy for bodily functions and materials for growth and repair.
3	Connections		
	a	Students use the models to describe* causal accounts of the relationships between energy from the sun and animals' needs for energy, including that:	
		i.	Since all food can eventually be traced back to plants, all of the energy that animals use for body repair, growth, motion, and body warmth maintenance is energy that once came from the sun.
		ii.	Energy from the sun is transferred to animals through a chain of events that begins with plants producing food then being eaten by animals.

5-LS1-1 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

5-LS1-1. **Support an argument that plants get the materials they need for growth chiefly from air and water.** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Engaging in Argument from Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Support an argument with evidence, data, or a model.

Disciplinary Core Ideas

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

- Plants acquire their material for growth chiefly from air and water.

Crosscutting Concepts

Energy and Matter

- Matter is transported into, out of, and within systems.

Observable features of the student performance by the end of the grade:			
1	Supported claims		
	a	Students identify a given claim to be supported about a given phenomenon. The claim includes the idea that plants acquire the materials they need for growth chiefly from air and water.	
2	Identifying scientific evidence		
	a	Students describe* the given evidence, data, and/or models that support the claim, including evidence of:	
		i.	Plant growth over time.
		ii.	Changes in the weight of soil and water within a closed system with a plant, indicating:
			1. Soil does not provide most of the material for plant growth (e.g., changes in weight of soil and a plant in a pot over time, hydroponic growth of plants).
			2. Plants' inability to grow without water.
		iii.	Plants' inability to grow without air.
		iv.	Air is matter (e.g., empty object vs. air filled object).
3	Evaluating and critiquing evidence		
	a	Students determine whether the evidence supports the claim, including:	
		i.	Whether a particular material (e.g., air, soil) is required for growth of plants.
		ii.	Whether a particular material (e.g., air, soil) may provide sufficient matter to account for an observed increase in weight of a plant during growth.
4	Reasoning and synthesis		
	a	Students use reasoning to connect the evidence to support the claim with argumentation. Students describe* a chain of reasoning that includes:	
		i.	During plant growth in soil, the weight of the soil changes very little over time, whereas the weight of the plant changes a lot. Additionally, some plants can be grown without soil at all.
		ii.	Because some plants don't need soil to grow, and others show increases in plant matter (as measured by weight) but not accompanying decreases in soil matter, the material from soil must not enter the plant in sufficient quantities to be the chief contributor to plant growth.
		iii.	Therefore, plants do not acquire most of the material for growth from soil.
		iv.	A plant cannot grow without water or air. Because both air and water are matter and are transported into the plant system, they can provide the materials plants need for growth.
		v.	Since soil cannot account for the change in weight as a plant grows and since plants take in water and air, both of which could contribute to the increase in weight during plant growth, plant growth must come chiefly from water and air.

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

5-LS2-1. **Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.**[Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop a model to describe phenomena.

\- - - - - - - - - - - - - - - - - - - -

Connections to the Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science explanations describe the mechanisms for natural events.

Disciplinary Core Ideas

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.

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.

Crosscutting Concepts

Systems and System Models

- A system can be described in terms of its components and their interactions.

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students develop a model to describe* a phenomenon that includes the movement of matter within an ecosystem. In the model, students identify the relevant components, including:	
		i.	Matter.
		ii.	Plants.
		iii.	Animals.
		iv.	Decomposers, such as fungi and bacteria.
		v.	Environment.
2	Relationships		
	a	Students describe* the relationships among components that are relevant for describing* the phenomenon, including:	
		i.	The relationships in the system between organisms that consume other organisms, including:
			1. Animals that consume other animals.
			2. Animals that consume plants.

		3. Organisms that consume dead plants and animals.
		4. The movement of matter between organisms during consumption.
		ii. The relationship between organisms and the exchange of matter from and back into the environment (e.g., organisms obtain matter from their environments for life processes and release waste back into the environment, decomposers break down plant and animal remains to recycle some materials back into the soil).
3	Connections	
	a	Students use the model to describe*:
		i. The cycling of matter in the system between plants, animals, decomposers, and the environment.
		ii. How interactions in the system of plants, animals, decomposers, and the environment allow multiple species to meet their needs.
		iii. That newly introduced species can affect the balance of interactions in a system (e.g., a new animal that has no predators consumes much of another organism's food within the ecosystem).
		iv. That changing an aspect (e.g., organisms or environment) of the ecosystem will affect other aspects of the ecosystem.

5-ESS1-2 Earth's Place in the Universe

Students who demonstrate understanding can:

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.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [*Assessment Boundary: Assessment does not include causes of seasons.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K- 12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data
Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

- Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.

Disciplinary Core Ideas

ESS1.B: Earth and the Solar System

- 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.

Crosscutting Concepts

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

Observable features of the student performance by the end of the grade:			
1	Organizing data		
	a	Using graphical displays (e.g., bar graphs, pictographs), students organize data pertaining to daily and seasonal changes caused by the Earth's rotation and orbit around the sun. Students organize data that include:	
		i.	The length and direction of shadows observed several times during one day.
		ii.	The duration of daylight throughout the year, as determined by sunrise and sunset times.
		iii.	Presence or absence of selected stars and/or groups of stars that are visible in the night sky at different times of the year.
2	Identifying relationships		
	a	Students use the organized data to find and describe* relationships within the datasets, including:	
		i.	The apparent motion of the sun from east to west results in patterns of changes in length and direction of shadows throughout a day as Earth rotates on its axis.
		ii.	The length of the day gradually changes throughout the year as Earth orbits the sun, with longer days in the summer and shorter days in the winter.
		iii.	Some stars and/or groups of stars (i.e., constellations) can be seen in the sky all year, while others appear only at certain times of the year.
	b	Students use the organized data to find and describe* relationships among the datasets, including:	
		i.	Similarities and differences in the timing of observable changes in shadows, daylight, and the appearance of stars show that events occur at different rates (e.g., Earth rotates on its axis once a day, while its orbit around the sun takes a full year).

5-ESS3-1 Earth and Human Activity

Students who demonstrate understanding can:

5-ESS3-1. **Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.**

The performance expectation above was developed using the following elements from the NRC document *A Framework for K- 12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.	**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.	**Systems and System Models** • A system can be described in terms of its components and their interactions. - ***Connections to Nature of Science*** **Science Addresses Questions About the Natural and Material World.** • Science findings are limited to questions that can be answered with empirical evidence.

Observable features of the student performance by the end of the grade:			
1	Obtaining information		
	a	Students obtain information from books and other reliable media about:	
		i.	How a given human activity (e.g., in agriculture, industry, everyday life) affects the Earth's resources and environments.
		ii.	How a given community uses scientific ideas to protect a given natural resource and the environment in which the resource is found.
2	Evaluating information		
	a	Students combine information from two or more sources to provide and describe* evidence about:	
		i.	The positive and negative effects on the environment as a result of human activities.
		ii.	How individual communities can use scientific ideas and a scientific understanding of interactions between components of environmental systems to protect a natural resource and the environment in which the resource is found.

3-5-ETS1-1 Engineering Design

Students who demonstrate understanding can:

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.**

The performance expectation above was developed using the following elements from the NRC document *A Framework for K- 12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems
Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

Disciplinary Core Ideas

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.

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- People's needs and wants change over time, as do their demands for new and improved technologies.

Observable features of the student performance by the end of the grade:		
1	Identifying the problem to be solved	
	a	Students use given scientific information and information about a situation or phenomenon to define a simple design problem that includes responding to a need or want.
	b	The problem students define is one that can be solved with the development of a new or improved object, tool, process, or system.
	c	Students describe* that people's needs and wants change over time.
2	Defining the boundaries of the system	
	a	Students define the limits within which the problem will be addressed, which includes addressing something people want and need at the current time.
3	Defining the criteria and constraints	
	a	Based on the situation people want to change, students specify criteria (required features) of a successful solution.
	b	Students describe* the constraints or limitations on their design, which may include:
		i. Cost.
		ii. Materials.
		iii. Time.