This sixth grade curriculum begins with a unit that connects two of the three disciplines—life science and physical science. In this unit, students consider how their own bodies work in order to think more deeply about the interaction between systems in the human body when doing physical activities. In this culminating project, students are asked to pick an activity that involves an object in motion and explain how their bodies make the movement of this object possible.

The integrated model requires students to access and use a wide range of ideas from prior grades. This content knowledge spans three different Disciplinary Core Ideas in this unit: PS3.B: Conservation of Energy and Energy Transfer, LS1.A: Structure and Function, and LS1.D: Information Processing.

As students explore these core ideas, they build on their skills in the following science and engineering practices: Developing and Using Models; Planning and Carrying Out Investigations; Engaging in Argument From Evidence; and Obtaining, Evaluating, and Communicating Information. In addition to science and engineering practices, students also continue to build on their knowledge of the following crosscutting concepts: Cause and Effect; Scale, Proportion, and Quantity; Systems and System Models; Energy and Matter; and Structure and Function.

\*This summary is based on information found in the NGSS Framework.

**K-8 Progression of Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts for Unit 1**

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| **Disciplinary Core Ideas** | **K-2** | **3-5** | **6-8** |
| **PS3.B**  **Conservation of Energy and Energy Transfer** | Sunlight warms Earth’s surface. | Moving objects contain energy. The faster the object moves, the more energy it has. Energy can be moved from place to place by moving objects, or through sound, light, or electrical currents. Energy can be converted from one form to another form. | Kinetic energy can be distinguished from the various forms of potential energy. Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter. |
| **LS1.A**  **Structure and Function** | All organisms have external parts that they use to perform daily functions. | Organisms have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction. | All living things are made up of cells. In organisms, cells work together to form tissues and organs that are specialized for particular body functions. |
| **LS1.D**  **Information Processing** | Animals sense and communicate information and respond to inputs with behaviors that help them grow and survive. | Different sense receptors are specialized for particular kinds of information; Animals use their perceptions and memories to guide their actions. | Each sense receptor responds to different inputs, transmitting them as signals that travel along nerve cells to the brain; The signals are then processed in the brain, resulting in immediate behavior or memories. |

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| **Science and Engineering Practices** | **K-2** | **3-5** | **6-8** |
| **Developing and Using Models\*** | Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.   * Develop and/or use a model to represent amounts, relationships, relative scales (bigger/smaller), and/or patterns in the natural and designed world(s). | Modeling in 3-5 builds on prior experiences and progresses to building and revising simple models and using models to represent events and design solutions.   * Develop and/or use models to describe and/or predict phenomena. | Modeling in 6-8 builds on prior experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.   * Develop and use model to describe phenomena. |
| **Planning and Carrying Out Investigations\*** | Planning and carrying out investigations in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.   * Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. | Planning and carrying out investigations in 3-5 builds on prior experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.   * 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. | Planning and carrying out investigations in 6-8 builds on prior experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.   * Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. |
| **Engaging in Argument From Evidence\*** | Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).   * Construct an argument with evidence to support a claim. | Engaging in argument from evidence in 3-5 builds on prior experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).   * Construct and/or support an argument with evidence, data, and/or a model. * Use data to evaluate claims about cause and effect. | Engaging in argument from evidence in 6-8 builds on prior experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).   * Construct, use, and/or present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. |
| **Obtaining, Evaluating, and Communicating Information\*** | Obtaining, evaluating, and communicating Information in K-2 builds on prior experiences and uses observations and texts to communicate new information.   * Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim. | Obtaining, evaluating, and communicating Information in 3-5 builds on prior 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. | Obtaining, evaluating, and communicating Information in 6-8 builds on prior experiences and progresses to evaluating the merit and validity of ideas and methods.   * Gather, read, and synthesize information from multiple appropriate sources ~~and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence~~. |

\*These SEPs are summatively assessed using the Culminating Project or a Task-Specific Rubric.

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| **Crosscutting Concepts** | **K-2** | **3-5** | **6-8** |
| **Cause and Effect\*** | Students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.   * Events have causes that generate observable patterns. | Students routinely identify and test causal relationships and use these relationships to explain change. They understand events that occur together with regularity might or might not signify a cause and effect relationship.   * Cause and effect relationships are routinely identified, tested, and used to explain change. | Students classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.   * Cause and effect relationships may be used to predict phenomena in natural or designed systems. |
| **Scale, Proportion, and Quantity\*** | Students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length.   * Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower). | Students recognize natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.   * 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 observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.   * Phenomena that can be observed at one scale may not be observable at another scale. |
| **Systems and System Models\*** | Students understand objects and organisms can be described in terms of their parts; and systems in the natural and designed world have parts that work together.   * Objects and organisms can be described in terms of their parts. * Systems in the natural and designed world have parts that work together. | Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.   * A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. * A system can be described in terms of its components and their interactions. | Students can understand that systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. They can use models to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. They can also learn that models are limited in that they only represent certain aspects of the system under study.   * Systems may interact with other systems; they may have sub-systems and be a part of a larger complex system. |
| **Energy and Matter\*** | N/A | Students learn matter is made of particles and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.   * Energy can be transferred in various ways and between objects. | Students learn matter is conserved because atoms are conserved in physical and chemical processes. They also learn that within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.   * Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). |
| **Structure and Function\*** | Students observe the shape and stability of structures of natural and designed objects are related to their function(s).   * The shape and stability of structures of natural and designed objects are related to their function(s). | Students learn different materials have different substructures, which can sometimes be observed; and substructures have shapes and parts that serve functions.   * Substructures have shapes and parts that serve functions. | Students model complex and microscopic structures and systems and visualize how their function depends on the shapes, composition, and relationships among its parts. They analyze many complex natural and designed structures and systems to determine how they function. They design structures to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.   * Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore complex natural structures/systems can be analyzed to determine how they function. |

\*These CCCs are summatively assessed using the Culminating Project or a Task-Specific Rubric.

**Progression of Knowledge from Kindergarten – 8th grade**

PS3.B. Conservation of Energy and Energy Transfer: In Kindergarten through second grade, students are first introduced to the idea of energy transfer by making observations of how sunlight warms the Earth’s surface and designing a device that can minimize this energy transfer. In third – fifth grade, students broaden their definition of energy from light and heat to include other indicators of energy (e.g., motion, sound, or electrical energy). As they investigate these types of energy, they also conceptualize how energy can be transferred between objects, resulting in different types of observable evidence. For example, when moving objects collide, energy is transferred to the surrounding air, producing heat and sound. This sets the foundation for this sixth grade unit, in which students use their knowledge of observable forms of energy to consider how energy transfers between objects are also associated with changes in kinetic energy. Later in this sixth grade unit, students will dive into two other Performance Expectations associated with this DCI, which focus on the relationship between thermal energy and kinetic energy of particles. While there is a clear focus on the CCC of Energy and Matter in this DCI, students also build their understanding of Cause and Effect and Scale, Proportion, and Quantity at different grade levels. Throughout all grade bands, there is a focus on the SEPs of Asking Questions, Planning and Carrying Out Investigations, and Designing Solutions.

The following is the progression of the Performance Expectations for this DCI:

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| **K-PS3-1** | Make observations to determine the effect of sunlight on Earth’s surface. |

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| **K-PS3-1**  **4-PS3-2** | Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.  Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents. |
| **4-PS3-3** | Ask questions and predict outcomes about the changes in energy that occur when objects collide. |
| **4-PS3-4** | Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. |
| **MS-PS3-3** | Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. |
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| **MS-PS3-4** | Plan an investigation to determine the relationships among the energy transferred and the change in the average kinetic energy of the particles as measured by the temperature of the sample. |
| **MS-PS3-5** | Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. |

LS1.A. Structure and Function: In Kindergarten through second grade, students are introduced to the concept of structure and function by thinking about how plants and animals have specific external parts that help them survive and grow. At this level, students are using these examples to mimic them in a design of their own. In fourth grade, students continue their exploration of the same concept but instead gather evidence to support an argument that both internal and external structures do in fact support survival, growth, behavior, and reproduction. This connection between the structures and functions of living things provides a solid foundation for this sixth grade unit, in which students consider structure and function within the context of the human body—how living things are made of cells, how cells have special structures for specific functions, and how the body has different sub-systems with specific functions that work together. The SEPs and CCCs vary widely from Kindergarten to Middle School, but the CCCs of Structure and Function and Systems and System Models show up multiple times throughout the grand bands.

The following is the progression of the Performance Expectations for this DCI:

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| **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. |
| **4-LS1-1** | Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. |
| **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. |
| **MS-LS1-2** | Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. |
| **MS-LS1-3** | Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. |

LS1.D. Information Processing: Kindergarten through second grade introduces this DCI with the same PE as LS1.A. Structure and Function. While the language of this PE implies a much greater focus on the concept of structure and function, the inclusion of this DCI emphasizes that some of these plant and animal structures function specifically to capture and convey different types of information. This sets the stage for students to delve more deeply into the neural pathways they may have implicitly studied in the K-2 grade band. In fourth grade, the neural pathway is basic—senses to brain to response. However, in this sixth grade unit, students expand on this process further, considering the different inputs and how they are transmitted as signals along nerve cells to the brain, processed, and sent back out along nerve cells to create a response. The SEPs and CCCs for this DCI are varied, with no specific focus throughout.

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| **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. |
| **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. |
| **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. |