**3-5 Teacher’s Guide to Nebraska’s College and**

**Career Ready Standards for Science**

**2017**

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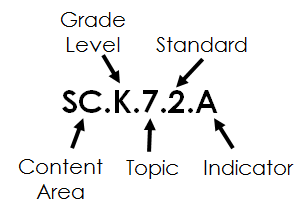
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**Content Area Standards Structure**

The overall structure of Nebraska’s College and Career Ready Standards for Science (CCR-Science) reflects the two-tier structure common across all Nebraska content area standards. The two levels within the structure include **standards** and **indicators**. At the broadest level, **standards** include broad, overarching content-based statements that describe the basic cognitive, affective, or psychomotor indicators of student learning. The standards, across all grade levels, reflect long-term goals for learning. **Indicators** further describe what students must know and be able to do to meet the standard. These performance-based statements provide clear indicators related to student learning in each content area. Additionally, indicators provide guidance related to the assessment of student learning. This guidance is articulated by including assessment boundary statements.

The CCR-Science standards describe the knowledge and skills that students should learn, but they do not prescribe particular curriculum, lessons, teaching techniques, or activities. Standards describe what students are expected to know and be able to do, while the local curriculum describes how teachers will help students master the standards. A wide variety of instructional resources may be used to meet the state content area standards. Decisions about curriculum and instruction are made locally by individual school districts and classroom teachers. The Nebraska Department of Education does not mandate the curriculum used within a local school.

In addition to a common structure for content area standards, a consistent numbering system is used for content area standards. The CCR-Science standards numbering system is as follows:

**Organization and Structure of CCR-Science Standards**

Nebraska’s College and Career Ready Standards for Science (CCR-Science) are organized by grade level for grades K-8 and by grade span in high school. K-5 standards are organized to reflect the developmental nature of learning for elementary students and attend to the learning progressions that build foundational understandings of science. By the time students reach middle school (Grades 6-8), they build on this foundation in order to develop more sophisticated understandings of science concepts through high school. The topic progression for the CCR-Science standards is included in Appendix A.

Within each grade level/span the standards are organized around topics, and each standard addresses one topic. Each CCR-Science standard begins with the common stem: “Gather, analyze, and communicate…” This stem highlights long-term learning goals associated with rigorous science standards and provides guidance for high quality classroom instruction. To facilitate high-quality instruction, students actively gather evidence from multiple sources related to the science topics. This evidence is carefully analyzed in order to describe and explain natural phenomena, and then, students communicate their understanding of the content using a variety of tools and strategies. It is important to note that while topics are introduced in a spiraled model, they are connected; and deeper understanding at subsequent grade levels and spans requires foundational understanding of multiple topics.

The indicators reflect the three dimensions of science learning outlined in *A Framework for K-12 Science Education1.* Each CCR-Science indicator includes a disciplinary core idea, a crosscutting concept (underline), and a **science and engineering practice** (**bold**).

The disciplinary core ideas are the focused, limited set of science ideas identified in the *Framework* as necessary for ALL students throughout their education and beyond their K-12 school years to achieve scientific literacy. The limited number of disciplinary core ideas allows more time for students and teachers to engage in the science and engineering practices as they deeply explore science ideas. To allow students to continually build on and revise their knowledge and abilities, the disciplinary core ideas are built on developmental learning progressions (Appendix A).

The crosscutting concepts are used to organize and make sense of disciplinary core ideas. They serve as tools that bridge disciplinary boundaries and deepen understanding of science content. With grade-appropriate proficiency, students are expected to use patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change as they gather, analyze, and communicate scientific understanding. These crosscutting concepts provide structure for synthesizing knowledge from various fields into a coherent and scientifically based view of the world.

The **science and engineering practices** are used by students to demonstrate understanding of the disciplinary core ideas and crosscutting concepts. Engaging in the practices of science and engineering helps students understand the wide range of approaches used to investigate natural phenomena and develop solutions to challenges. Students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems; developing and using models; planning and carrying out investigations; analyzing and interpreting data; using mathematics and computational thinking; constructing explanations and designing solutions; engaging in argument from evidence; and obtaining, evaluating, and communicating information as they gather, analyze, and communicate scientific information.

Each science indicator focuses on one crosscutting concept and one **science and engineering practice** as an *example* to guide assessment. Instruction aimed toward preparing students should use crosscutting concepts and **science and engineering practices** that go beyond what is stated in the indicator to better reflect authentic science practice.

The following table lists the disciplinary core ideas, crosscutting concepts, and **science and engineering practices**:

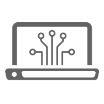
|  |  |  |
| --- | --- | --- |
| [**Science and Engineering Practices**](https://www.nap.edu/read/13165/chapter/7)   * **[Asking Questions and Defining Problems](https://www.nap.edu/read/13165/chapter/7" \l "54)** * **[Developing and Using Models](https://www.nap.edu/read/13165/chapter/7" \l "56)** * **[Planning and Carrying Out Investigations](https://www.nap.edu/read/13165/chapter/7" \l "59)** * [**Analyzing and Interpreting Data**](https://www.nap.edu/read/13165/chapter/7#61) * **[Using Mathematics and Computational Thinking](https://www.nap.edu/read/13165/chapter/7" \l "64)** * **[Constructing Explanations and Designing Solutions](https://www.nap.edu/read/13165/chapter/7" \l "67)** * **[Engaging in Argument from Evidence](https://www.nap.edu/read/13165/chapter/7" \l "71)** * [**Obtaining, Evaluating, and Communicating Information**](https://www.nap.edu/read/13165/chapter/7#74) | **Disciplinary Core Ideas**  [**LS1**](https://www.nap.edu/read/13165/chapter/10#143)**: From Molecules to Organisms:   Structures and Processes** [**LS2**](https://www.nap.edu/read/13165/chapter/10#150)**: Ecosystems: Interactions, Energy,   and Dynamics** [**LS3**](https://www.nap.edu/read/13165/chapter/10#157)**: Heredity: Inheritance and of Traits** [**LS4**](https://www.nap.edu/read/13165/chapter/10#161)**: Biological Evolution: Unity & Diversity** [**PS1**](https://www.nap.edu/read/13165/chapter/9#106)**: Matter and Its Interactions** [**PS2**](https://www.nap.edu/read/13165/chapter/9#113)**: Motion and Stability: Forces and   Interactions** [**PS3**](https://www.nap.edu/read/13165/chapter/9#120)**: Energy** [**PS4**](https://www.nap.edu/read/13165/chapter/9#130)**: Waves and Their Applications in   Technologies for Information Transfer** [**ESS1**](https://www.nap.edu/read/13165/chapter/11#173)**: Earth’s Place in the Universe** [**ESS2**](https://www.nap.edu/read/13165/chapter/11#179)**: Earth’s Systems** [**ESS3**](https://www.nap.edu/read/13165/chapter/11#190)**: Earth and Human Activity** [**ETS1**](https://www.nap.edu/read/13165/chapter/12#204)**: Engineering Design** | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png[**Crosscutting Concepts**](https://www.nap.edu/read/13165/chapter/8)  [C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Patterns**](https://www.nap.edu/read/13165/chapter/8#85) [**Cause and Effect**](https://www.nap.edu/read/13165/chapter/8#87)  [**Scale, Proportion, and Quantity**](https://www.nap.edu/read/13165/chapter/8#89)C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png  C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png[**Systems and System Models**](https://www.nap.edu/read/13165/chapter/8#91)  C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png  [**Energy and Matter**](https://www.nap.edu/read/13165/chapter/8#94)  C:\Users\sara.cooper.NDE\Desktop\Standards\StructureFunction.png[**Structure and Function**](https://www.nap.edu/read/13165/chapter/8#96)  C:\Users\sara.cooper.NDE\Desktop\Standards\StabilityChange.png  [**Stability and Change**](https://www.nap.edu/read/13165/chapter/8#98) |



**Nebraska Connections**

Opportunities to teach science using topics directly relevant to our state (e.g. Ogallala Aquifer, agriculture, Nebraska-specific flora and fauna, Nebraska’s rich geologic history, etc.) are listed throughout the CCR-Science standards as “Nebraska Connections.” These connections allow educators to use local, regional, and state-specific contexts for teaching, learning, and assessment. Educators should use these as recommendations for investigation with students. Additionally, assessment developers have the opportunity to use the Nebraska contexts to develop Nebraska-specific examples or scenarios from which students would demonstrate their general understanding. This approach provides the opportunity for educators to draw upon Nebraska’s natural environment and rich history and resources in engineering design and scientific research to support student learning.

**Civic Science Connections**

****Within the CCR-Science standards, opportunities to create civic science connections have been identified. These connections are designed to call-out the importance for students to engage in the study of civic ideals, principles, and practices through participation in the act of “citizen science.” Citizen science is the public involvement in inquiry and discovery of new scientific knowledge. This engagement helps students build science knowledge and skills while improving social behavior, increasing student engagement, and strengthening community partnerships. Citizen science projects enlist K-12 students to collect or analyze data for real-world research studies. Citizen science in conjunction with the CCR-Science standards help bridge our K-12 students with stakeholders in the community, both locally and globally.

**Computer Science Connections**Natural connections between science and computer science have been identified throughout the standards, especially in the middle level and in high school as students expand their ability to use computational thinking to develop complex models and simulations of natural and designed systems. Computers and other digital tools allow students to collect, record, organize, analyze, and communicate data as they engage in science learning.

**Engineering, Technology, and Applications of Science Connections**Connections to engineering, technology, and applications of science are included at all grade levels and in all domains. These connections highlight the interdependence of science, engineering, and technology that drives the research, innovation, and development cycle where discoveries in science lead to new technologies developed using the engineering design process. Additionally, these connections call attention to the effects of scientific and technological advances on society and the environment.

** Engineering Design**Performance indicators for the engineering design process are intentionally embedded in all grade levels. These indicators allow students to demonstrate their ability to define problems, develop possible solutions, and improve designs. ***These indicators should be reinforced whenever students are engaged in practicing engineering design during instruction.*** Having students engage in the engineering design process will prepare them to solve challenges both in and out of the classroom.

**Instructional Shifts**While each indicator incorporates the three dimensions, this alone does not drive student outcomes; ultimately, student learning depends on how the standards are translated to instructional practices.

*3-Dimensional teaching and learning:* Effective science teaching, learning, and assessment should integrate disciplinary core ideas, crosscutting concepts, and **science and engineering** **practices**. Integration of the three dimensions will allow students to explain scientific phenomena, design solutions to real-world challenges, and build a foundation upon which they can continue to learn and to apply science knowledge and skills within and outside the K-12 education arena.

*Integrated science:* Natural phenomena serve as the context for the work of both scientists and engineers. As students explain natural phenomena and design solutions to real-world challenges they connect ideas across science domains. The crosscutting concepts serve as tools that bridge domain boundaries and allow students to deepen their understanding of disciplinary core ideas while using **science and engineering practices** as they explore natural phenomena.

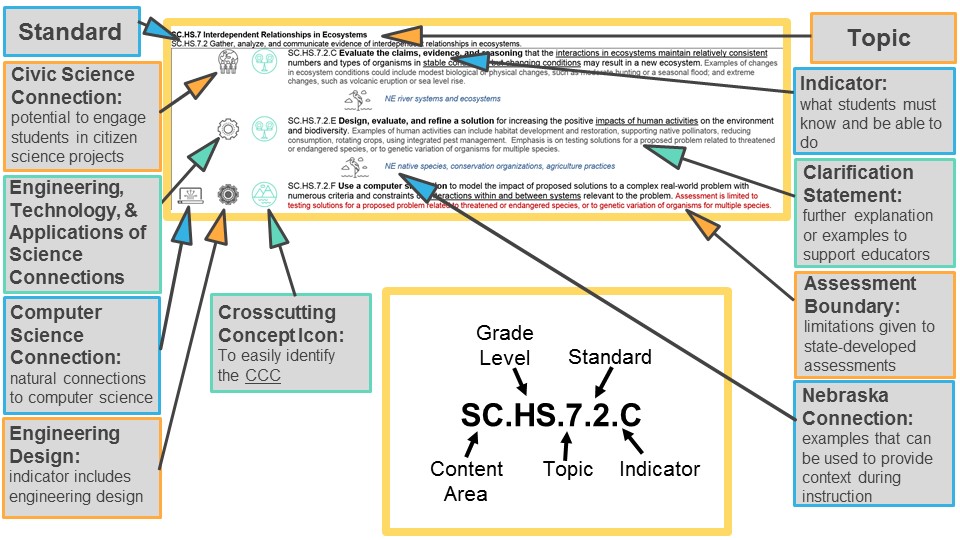
*Interdisciplinary approaches:* The overlapping skills included in the **science and engineering practices** and the intellectual tools provided by the crosscutting concepts build meaningfuland substantive connections to interdisciplinary knowledge and skills in all content areas(English Language Arts, mathematics, social studies, fine arts, career/technical education,etc.) This affords all student equitable access to learning and ensures all students are preparedfor college, career, and citizenship.

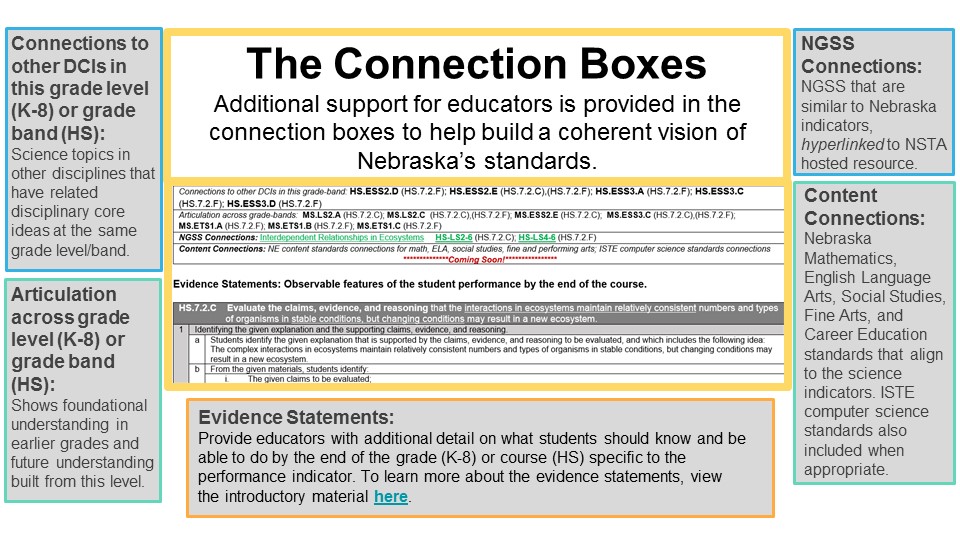
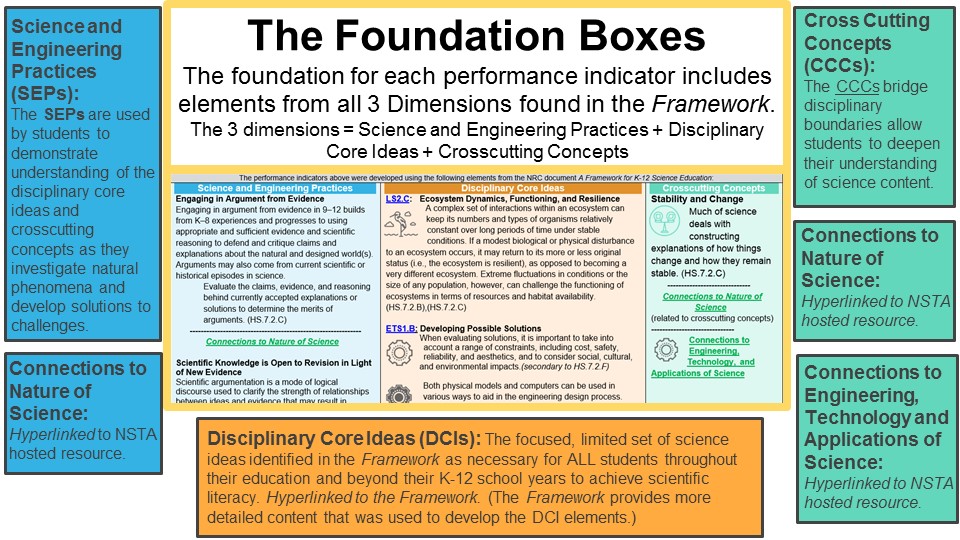
**Implementation**Effective science teaching, learning, and assessments should integrate disciplinary core ideas, crosscutting concepts, and **science and engineering practices**. Integration of the three dimensions will allow students to explain scientific phenomena, design solutions to problems, and build a foundation upon which they can continue to learn and be able to apply science knowledge and skills within and outside the K-12 education arena. While each indicator incorporates the three dimensions, this alone does not drive student outcomes. Ultimately, student learning depends on how the standards are translated to instructional practices.

1 *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Washington, DC: The National Academies Press,

2012.

**How to Read the Teacher’s Guide**





**[here](https://www.nextgenscience.org/sites/default/files/Front%20Matter%20Evidence%20Statements%20PDF%20Jan%202015_1.pdf)**.

**THIRD GRADE**

The third grade standards and indicators help students gather, analyze, and communicate evidence as they formulate answers to questions tailored to student interest and current topics that may include but are not limited to:

**How do equal and unequal forces on an object affect the object?**

Students are able to determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electrical or magnetic interactions between two objects not in contact with each other.

**How can magnets be used?**

Students are able to apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

**How do organisms vary in their traits?**

Students are expected to develop an understanding of the similarities and differences of organisms’ life cycles. Students develop an understanding that organisms have different inherited traits and that the environment can also affect the traits that an organism develops. In addition, students are able to construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

**How are plants, animals, and environments of the past similar or different from current plants, animals, and environments?**

Students are expected to develop an understanding of types of organisms that lived long ago, and also about the nature of their environments.

**What happens to organisms when their environment changes?**

Students are expected to develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die.

**What is typical weather in different parts of the world and during different times of the year?**

Students are able to organize and use data to describe typical weather conditions expected during a particular season.

**How can the impact of weather-related hazards be reduced?**

By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards.

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**SC.3.1 Forces and Interactions: Motion and Stability**

SC.3.1.1 Gather, analyze, and communicate evidence of forces and their interactions.

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| --- | --- | --- | --- |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.1.1.A **Plan and conduct an investigation** to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all. Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down. |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.3.1.1.B **Make observations and/or measurements** of an object's motion to provide evidence that a pattern can be used to predict future motion. Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw. Assessment does not include technical terms such as period and frequency. |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.1.1.C **Ask questions** to determine cause and effect relationships of electrical or magnetic interactions between two objects not in contact with each other. Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force. Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions, are limited to static electricity. |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.3.1.1.D **Define a simple design problem** that can be solved by applying scientific ideas about magnets. Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other. |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **Science and Engineering Practices**  **Asking Questions and Defining Problems**  Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.   * Ask questions that can be investigated based on patterns such as cause and effect relationships. (3.1.1.C) * Define a simple problem that can be solved through the development of a new or improved object or tool. (3.1.1.D)   **Planning and Carrying Out Investigations**  Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 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. (3.1.1.A) * Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3.1.1.B)   **---------------------------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Science Knowledge is Based on Empirical Evidence**   * Science findings are based on recognizing patterns. (3.1.1.B)   **Scientific Investigations Use a Variety of Methods**   * Science investigations use a variety of methods, tools, and techniques. (3.1.1.A) | **Disciplinary Core Ideas**  [**PS2.A**](https://www.nap.edu/read/13165/chapter/9#114)**: Forces and Motion**   * Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object’s speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3.1.1.A) * The patterns of an object’s motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3.1.1.B)   [**PS2.B**](https://www.nap.edu/read/13165/chapter/9#116)**: Types of Interactions**   * Objects in contact exert forces on each other. (3.1.1.A) * Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3.1.1.C),(3.1.1.D) | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png**Patterns**  Patterns of change can be used to make predictions. (3.1.1.B)  **Cause and Effect**  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.pngCause and effect relationships are routinely identified. (3.1.1.A)  Cause and effect relationships are routinely identified, tested, and   used to explain change. (3.1.1.C)  **----------------------------------------------------**  *C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png*[[***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Interdependence of Science, Engineering, and Technology**   * Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3.1.1.D) |
| *Connections to other DCIs in third grade:* N/A | | |
| *Articulation of DCIs across grade-levels:***K.PS2.A** (3.1.1.A); **K.PS2.B** (3.1.1.A); **K.PS3.C** (3.1.1.A); **K.ETS1.A** (3.1.1.D); **1.ESS1.A** (3.1.1.B); **4.PS4.A** (3.1.1.B); **4.ETS1.A** (3.1.1.D); **5.PS2.B** (3.1.1.A); **MS.PS2.A** (3.1.1.A),(3.1.1.B); **MS.PS2.B** (3.1.1.C),(3.1.1.D); **MS.ESS1.B** (3.1.1.A),(3.1.1.B); **MS.ESS2.C** (3.1.1.A) | | |
| *NGSS Connections:* [Forces and Interactions](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=11)[**3-PS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=46) (3.1.1.A); [**3-PS2-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=47) (3.1.1.B); [**3-PS2-3**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=48) (3.1.1.C); [**3-PS2-4**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=50) (3.1.1.D) | | |
| *ELA Connections:*  3.1.6.hConstruct and/or answer literal and inferential questions and support answers with specific evidence from the text or additional sources. (3.1.1.A),(3.1.1.C)  3.1.6.j Identify and apply knowledge of organizational patterns to comprehend informational text (e.g. sequence, description, cause and effect, compare/contrast). (3.1.1.C)  3.2.1.c Gather and use relevant information and evidence from one or more authoritative print and/or digital sources to support claims or theses. (3.1.1.A),(3.1.1.B)  3.2.1.i Display academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (3.1.1.A),(3.1.1.B)  3.2.2.c Conduct and publish research to answer questions or solve problems using multiple resources to support theses. (3.1.1.A),(3.1.1.B)  3.3.1.e Ask pertinent questions to acquire or confirm information. (3.1.1.C)  3.3.2.a Demonstrate active and attentive listening skills (e.g., eye contact, nonverbal cues, recalling, questioning) for multiple situations and modalities. (3.1.1.C)  3.3.3.d Listen, ask clarifying questions, summarize, and respond to information being communicated and consider its contribution to a topic, text, or issue under study. (3.1.1.C)  3.4.1.a Locate, organize, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (3.1.1.A),(3.1.1.B) | | |
| *Mathematics Connections:*  MP.1 Solves mathematical problems. *(3.1.1.A)*  MP.3 Communicates mathematical ideas effectively *(3.1.1.A)*  3.3.3.dIdentify and use the appropriate tools and units of measurement, both customary and metric, to solve real-world problems  involving length, weight, mass, liquid volume, and capacity (within the same system and unit). *(3.1.1.A)* | | |
| *Social Studies Connections:* | | |
|  | | |

**Evidence Statements: Observable features of the student performance by the end of the grade.**

|  |  |  |
| --- | --- | --- |
| **3.1.1.A Plan and conduct an investigation** to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. | | |
| 1 | Identifying the phenomenon under investigation | |
| a | Students identify and describe\* the phenomenon under investigation, which includes the effects of different forces on an object’s motion (e.g., starting, stopping, or changing direction). |
| b | Students describe\* the purpose of the investigation, which includes producing data to serve as the basis for evidence for how balanced and unbalanced forces determine an object’s motion. |
| 2 | Identifying the evidence to address the purpose of the investigation | |
| a | Students collaboratively develop an investigation plan. In the investigation plan, students describe\* the data to be collected, including: |
| 1. The change in motion of an object at rest after: |
| 1. Different strengths and directions of balanced forces (forces that sum to zero) are applied to the object. |
| 1. Different strengths and directions of unbalanced forces (forces that do not sum to zero) are applied to the object (e.g., strong force on the right, weak force or the left). |
| 1. What causes the forces on the object. |
| b | Students individually describe\* how the evidence to be collected will be relevant to determining the effects of balanced and unbalanced forces on an object’s motion. |
| 3 | Planning the investigation | |
| a | In the collaboratively developed investigation plan, students describe\* how the motion of the object will be observed and recorded, including defining the following features: |
| 1. The object whose motion will be investigated. |
| 1. The objects in contact that exert forces on each other. |
| 1. Changing one variable at a time (e.g., control strength and vary the direction, or control direction and vary the strength). |
| 1. The number of trials that will be conducted in the investigation to produce sufficient data. |
| b | Students individually describe\* how their investigation plan will allow them to address the purpose of the investigation. |
| 4 | Collecting the data | |
| a | Students collaboratively collect and record data according to the investigation plan they developed, including data from observations and/or measurements of: |
| 1. An object at rest and the identification of the forces acting on the object. |
| 1. An object in motion and the identification of the forces acting on the object. |

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| **3.1.1.B Make observations and/or measurements** of an object's motion to provide evidence that a pattern can be used to predict future motion. | | |
| 1 | Identifying the phenomenon under investigation | |
| a | From the given investigation plan, students identify and describe\* the phenomenon under investigation, which includes observable patterns in the motion of an object. |
| b | Students identify and describe\* the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon that includes the idea that patterns of motion can be used to predict future motion of an object. |
| 2 | Identifying the evidence to address the purpose of the investigation | |
| a | Based on a given investigation plan, students identify and describe\* the data to be collected through observations and/or measurements, including data on the motion of the object as it repeats a pattern over time (e.g., a pendulum swinging, a ball moving on a curved track, a magnet repelling another magnet). |
| b | Students describe\* how the data will serve as evidence of a pattern in the motion of an object and how that pattern can be used to predict future motion. |
| 3 | Planning the investigation | |
| a | From the given investigation plan, students identify and describe\* how the data will be collected, including how: |
| 1. The motion of the object will be observed and measured. |
| 1. Evidence of a pattern in the motion of the object will be identified from the data on the motion of the object. |
| 1. The pattern in the motion of the object can be used to predict future motion. |
| 4 | Collecting the data | |
| a | Students make observations and/or measurements of the motion of the object, according to the given investigation plan, to identify a pattern that can be used to predict future motion. |

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| **3.1.1.C Ask questions** to determine cause and effect relationships of electrical or magnetic interactions between two objects not in contact with   each other. | | |
| 1 | Addressing phenomena of the natural world | |
| a | Students ask questions that arise from observations of two objects not in contact with each other interacting through electric or magnetic forces, the answers to which would clarify the cause-and-effect relationships between: |
| 1. The sizes of the forces on the two interacting objects due to the distance between the two objects. |
| 1. The relative orientation of two magnets and whether the force between the magnets is attractive or repulsive. |
| 1. The presence of a magnet and the force the magnet exerts on other objects. |
| 1. Electrically charged objects and an electric force. |
| 2 | Identifying the scientific nature of the question | |
| a | Students’ questions can be investigated within the scope of the classroom. |

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| **3.1.1.D Define a simple design problem** that can be solved by applying scientific ideas about magnets. | | |
| 1 | Identifying the problem to be solved | |
| a | Students identify and describe\* a simple design problem that can be solved by applying a scientific understanding of the forces between interacting magnets. |
| b | Students identify and describe\* the scientific ideas necessary for solving the problem, including: |
| 1. Force between objects do not require that those objects be in contact with each other |
| 1. The size of the force depends on the properties of objects, distance between the objects, and orientation of magnetic objects relative to one another. |
| 2 | Defining the criteria and constraints | |
| a | Students identify and describe\* the criteria (desirable features) for a successful solution to the problem. |
| b | Students identify and describe\* the constraints (limits) such as: |
| 1. Time. |
| 1. Cost. |
| 1. Materials. |

**SC.3.7 Interdependent Relationships in Ecosystems**SC.3.7.2 Gather and analyze data to communicate an understanding of the interdependent relationships in ecosystems.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.7.2.A **Construct an argument** that some animals form groups that help members survive. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE animals* |
|  | **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.3.7.2.B **Analyze and interpret data** from fossils to provide evidence of the organisms and environments in which they lived long ago. Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms. Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE fossils; NE geologic history* |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.7.2.C **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. Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE habitats* |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png | CS: SC.3.7.2.D **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. Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms. Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE habitats* |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png |  | SC.3.7.2.E **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. | |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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.   * Analyze and interpret data to make sense of phenomena using logical reasoning. (3.7.2.B)   **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 worlds.   * Construct an argument with evidence, data, and/or a model. (3.7.2.A) * Construct an argument with evidence. (3.7.2.C) * Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3.7.2.D)   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.   * Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3.7.2.E) | **Disciplinary Core Ideas**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**LS2.C**](https://www.nap.edu/read/13165/chapter/10?term=LS2.C#154)**: Ecosystem Dynamics, Functioning, and Resilience**  When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. *(secondary to 3.7.2.D)*  [**LS2.D**](https://www.nap.edu/read/13165/chapter/10?term=LS2.C#156)**: Social Interactions and Group Behavior**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngBeing part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (3.7.2.A)  [**LS4.A**](https://www.nap.edu/read/13165/chapter/10?term=LS4.A#162)**: Evidence of Common Ancestry and Diversity**   * C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngSome kinds of plants and animals that once lived on Earth are no longer found anywhere. (3.7.2.B)   Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3.7.2.B)  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**LS4.C**](https://www.nap.edu/read/13165/chapter/10?term=LS4.c#164)**: Adaptation**  For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3.7.2.C)  [**LS4.D**](https://www.nap.edu/read/13165/chapter/10#166)**: Biodiversity and Humans**  Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3.7.2.D)  [**ETS1.B**](https://www.nap.edu/read/13165/chapter/12#206)**: Developing Possible Solutions**  Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a  range of likely conditions. (3.7.2.E)   * At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3.7.2.E) | **Crosscutting Concepts**  **Cause and Effect**  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.pngCause and effect relationships are routinely identified and used to explain change. (3.7.2.A),(3.7.2.C)  C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png**Scale, Proportion, and Quantity**  Observable phenomena exist from very short to very long time periods. (3.7.2.B)  C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png**Systems and System Models**  A system can be described in terms of its components and their interactions. (3.7.2.D)  C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png**-----------------------------------**  [***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Interdependence of Science, Engineering, and Technology**   * Knowledge of relevant scientific concepts and research findings is important in engineering. (3.7.2.D)   **Influence of Science, Engineering, and Technology on Society and the Natural World**   * Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3.7.2.E)   **---------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Scientific Knowledge Assumes an Order and Consistency in Natural Systems**   * Science assumes consistent patterns in natural systems. (3.7.2.B) |
| *Connections to other DCIs in third grade:* **3.ESS2.D** (3.7.2.C); **3.ESS3.B** (3.7.2.D) | | |
| *Articulation of DCIs across grade-levels:***K.ESS3.A** (3.7.2.C)(3.7.2.D); **K.ETS1.A** (3.7.2.D); **1.LS1.B** (3.7.2.A); **2.LS2.A** (3.7.2.C),(3.7.2.D); **2.LS4.D** (3.7.2.C),(3.7.2.D); **4.ESS1.C** (3.7.2.B); **4.ESS3.B** (3.7.2.D); **4.ETS1.A** (3.7.2.D);**MS.LS2.A** (3.7.2.A),(3.7.2.B)(3.7.2.C),(3.7.2.D); **MS.LS2.C** (3.7.2.D); **MS.LS4.A** (3.7.2.B); **MS.LS4.B** (3.7.2.C); **MS.LS4.C** (3.7.2.C),(3.7.2.D); **MS.ESS1.C** (3.7.2.B),(3.7.2.C),(3.7.2.D); **MS.ESS2.B** (3.7.2.B); **MS.ESS3.C** (3.7.2.D) | | |
| *NGSS Connections:*  [Interdependent Relationships in Ecosystems](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=12)  [**3-LS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=55) (3.7.2.A); [**3-LS4-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=63)(3.7.2.B); [**3-LS4-3**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=65) (3.7.2.C); [**3-LS4-4**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=68) (3.7.2.D); [Engineering Design](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=23) [**3-5ETS1-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=127) (3.7.2.E) | | |
| *ELA Connections:*  3.1.6.e Determine main ideas and supporting details from informational text and/or media. *(3.7.2.B),(3.7.2.C),(3LS4-4)*  3.1.6.h Compare and contrast similar themes, topics, and/or patterns of events in literary and informational texts to develop a multicultural perspective. (3.7.2.A),(3.7.2.B),(3.7.2.C),(3.7.2.D)  3.1.6.i Construct and/or answer literal and inferential questions and support answers with specific evidence from the text or additional sources. (3.7.2.A),(3.7.2.B),(3.7.2.C),(3.7.2.D)  3.1.6.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (3.7.2.A),(3.7.2.B),(3.7.2.C),(3.7.2.D)  3.2.1.b Generate a draft that develops a clear topic suited to the purpose and intended audience and organizational pattern, including a clear introduction, body, and conclusion with appropriate transitions. (3.7.2.A),(3.7.2.B),(3.7.2.C),(3.7.2.D)  3.2.1.iDisplay academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (3.7.2.B)  3.2.2.a Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats. (3.7.2.A),(3.7.2.B),(3.7.2.C),(3.7.2.D)  3.3.1.a Demonstrate appropriate speaking techniques (e.g. appropriate eye contact, adequate volume, clear pronunciation) for a variety of purposes and situations, including interpreting text. (3.7.2.C),(3.7.2.D) | | |
| *Mathematics Connections:*  MP.1 Solves mathematical problems. (3.7.2.B)  MP.2 Models and represents math problems. (3.7.2.A),(3.7.2.B),(3.7.2.C),(3.7.2.D)  MP.3 Communicates mathematical ideas effectively. (3.7.2.B),(3.7.2.C),(3.7.2.D)  3.1.1.c Round a whole number to the tens or hundreds place, using place value understanding or a visual representation. (3.7.2.A)  3.4.1.aCreate scaled pictographs and scaled bar graphs to represent a data set-including data collected through observations, surveys,   and experiments-with several categories. (3.7.2.C)  3.4.1.b Represent data using line plots where the horizontal scale is marked off in appropriate units-whole numbers, halves, or quarters.   (3.7.2.B)  3.3.3.e Estimate and measure length to the nearest half inch, quarter inch, and centimeter. (3.7.2.B) | | |
| *Social Studies Connections:* | | |
| *Fine Arts Connections:* | | |

**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **3.7.2.A Construct an argument** that some animals form groups that help members survive. | | |
| 1 | Supported claims | |
| a | Students make a claim to be supported about a phenomenon. In their claim, students include the idea that some animals form groups and that being a member of that group helps each member survive. |
| 2 | Identifying scientific evidence | |
| a | Students describe\* the given evidence, data, and/or models necessary to support the claim, including: |
| 1. Identifying types of animals that form or live in groups of varying sizes. |
| 1. Multiple examples of animals in groups of various sizes: |
| * 1. Obtaining more food for each individual animal compared to the same type of animal looking for food individually. |
| * 1. Displaying more success in defending themselves than those same animals acting alone. |
| * 1. Making faster or better adjustments to harmful changes in their ecosystem than would those same animals acting alone. |
| 3 | Evaluating and critiquing evidence | |
| a | Students evaluate the evidence to determine its relevance, and whether it supports the claim that being a member of a group has a survival advantage. |
| b | Students describe\* whether the given evidence is sufficient to support the claim and whether additional evidence is needed. |
| 4 | Reasoning and synthesis | |
| a | Students use reasoning to construct an argument connecting the evidence, data and/or models to the claim. Students describe\* the following reasoning in their argument: |
| 1. The causal evidence that being part of a group can have the effect of animals being more successful in obtaining food, defending themselves, and coping with change supports the claim that being a member of a group helps animals survive. |
| 1. The causal evidence that an animal losing its group status can have the effect of the animal obtaining less food, not being able to defend itself, and not being able to cope with change supports the claim that being a member of a group helps animals survive. |

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| **3.7.2.B Analyze and interpret data** from fossils to provide evidence of the organisms and environments in which they lived long ago. | | |
| 1 | Organizing data | |
| a | Students use graphical displays (e.g., table, chart, graph) to organize the given data, including data about: |
| 1. Fossils of animals (e.g., information on type, size, type of land on which it was found). |
| 1. Fossils of plants (e.g., information on type, size, type of land on which it was found). |
| 1. The relative ages of fossils (e.g., from a very long time ago). |
| 1. Existence of modern counterparts to the fossilized plants and animals and information on where they currently live. |
| 2 | Identifying relationships | |
| a | Students identify and describe\* relationships in the data, including: |
| 1. That fossils represent plants and animals that lived long ago. |
| 1. The relationships between the fossils of organisms and the environments in which they lived (e.g., marine organisms, like fish, must have lived in water environments). |
| 1. The relationships between types of fossils (e.g., those of marine animals) and the current environments where similar organisms are found. |
| 1. That some fossils represent organisms that lived long ago and have no modern counterparts. |
| 1. The relationships between fossils of organisms that lived long ago and their modern counterparts. |
| 1. The relationships between existing animals and the environments in which they currently live. |
| 3 | Interpreting data | |
| a | Students describe\* that: |
| 1. Fossils provide evidence of organisms that lived long ago but have become extinct (e.g., dinosaurs, mammoths, other organisms that have no clear modern counterpart). |
| 1. Features of fossils provide evidence of organisms that lived long ago and of what types of environments those organisms must have lived in (e.g., fossilized seashells indicate shelled organisms that lived in aquatic environments). |
| 1. By comparing data about where fossils are found and what those environments are like, fossilized plants and animals can be used to provide evidence that some environments look very different now than they did a long time ago (e.g., fossilized seashells found on land that is now dry suggest that the area in which those fossils were found used to be aquatic; tropical plant fossils found in Antarctica, where tropical plants cannot live today, suggests that the area used to be tropical). |

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| **3.7.2.C 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. | | |
| 1 | Supported claims | |
| a | Students make a claim to be supported about a phenomenon. In their claim, students include the idea that in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all. |
| 2 | Identifying scientific evidence | |
| a | Students describe\* the given evidence necessary for supporting the claim, including: |
| 1. Characteristics of a given particular environment (e.g., soft earth, trees and shrubs, seasonal flowering plants). |
| 1. Characteristics of a particular organism (e.g., plants with long, sharp leaves; rabbit coloration). |
| 1. Needs of a particular organism (e.g., shelter from predators, food, water). |
| 3 | Evaluating and critiquing evidence | |
| a | Students evaluate the evidence to determine: |
| 1. The characteristics of organisms that might affect survival. |
| 1. The similarities and differences in needs among at least three types of organisms. |
| 1. How and what features of the habitat meet the needs of each of the organisms (i.e., the degree to which a habitat meets the needs of an organism). |
| 1. How and what features of the habitat do not meet the needs of each of the organisms (i.e., the degree to which a habitat does not meet the needs of an organism). |
| b | Students evaluate the evidence to determine whether it is relevant to and supports the claim. |
| c | Students describe\* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed. |
| 4 | Reasoning and synthesis | |
| a | Students use reasoning to construct an argument, connecting the relevant and appropriate evidence to the claim, including describing\* that any particular environment meets different organisms’ needs to different degrees due to the characteristics of that environment and the needs of the organisms. Students describe\* a chain of reasoning in their argument, including the following cause-and-effect relationships: |
| 1. If an environment fully meets the needs of an organism, that organism can survive well within that environment. |
| 1. If an environment partially meets the needs of an organism, that organism can survive less well (e.g., lower survival rate, increased sickliness, shorter lifespan) than organisms whose needs are met within that environment. |
| 1. If an environment does not meet the needs of the organism, that organism cannot survive within that environment. |
| 1. Together, the evidence suggests a causal relationship within the system between the characteristics of a habitat and the survival of organisms within it. |

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| **3.7.2.D 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. | | |
| 1 | Supported claims | |
| a | Students make a claim about the merit of a given solution to a problem that is caused when the environment changes, which results in changes in the types of plants and animals that live there. |
| 2 | Identifying scientific evidence | |
| a | Students describe\* the given evidence about how the solution meets the given criteria and constraints. This evidence includes: |
| 1. A system of plants, animals, and a given environment within which they live before the given environmental change occurs. |
| 1. A given change in the environment. |
| 1. How the change in the given environment causes a problem for the existing plants and animals living within that area. |
| 1. The effect of the solution on the plants and animals within the environment. |
| 1. The resulting changes to plants and animals living within that changed environment, after the solution has been implemented. |
| 3 | Evaluating and critiquing evidence | |
| a | Students evaluate the solution to the problem to determine the merit of the solution. Students describe\* how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including: |
| 1. How well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including: |
| * 1. How the solution makes changes to one part (e.g., a feature of the environment) of the system, affecting the other parts of the system (e.g., plants and animals). |
| * 1. How the solution affects plants and animals. |
| b | Students evaluate the evidence to determine whether it is relevant to and supports the claim. |
| c | Students describe\* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed. |

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| **3.7.2.E 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. | | |
| 1 | Using scientific knowledge to generate design solutions | |
| a | Students use grade-appropriate information from research about a given problem, including the causes and effects of the problem and relevant scientific information. |
| b | Students generate at least two possible solutions to the problem based on scientific information and understanding of the problem. |
| c | Students specify how each design solution solves the problem. |
| d | Students share ideas and findings with others about design solutions to generate a variety of possible solutions. |
| e | Students describe\* the necessary steps for designing a solution to a problem, including conducting research and communicating with others throughout the design process to improve the design [note: emphasis is on what is necessary for designing solutions, not on a step-wise process]. |
| 2 | Describing\* criteria and constraints, including quantification when appropriate | |
| a | Students describe\*: |
| 1. The given criteria (required features) and constraints (limits) for the solutions, including increasing benefits, decreasing risks/costs, and meeting societal demands as appropriate. |
| 1. How the criteria and constraints will be used to generate and test the design solutions. |
| 3 | Evaluating potential solutions | |
| a | Students test each solution under a range of likely conditions and gather data to determine how well the solutions meet the criteria and constraints of the problem. |
| b | Students use the collected data to compare solutions based on how well each solution meets the criteria and constraints of the problem. |

**SC.3.9 Inheritance and Variation: Life Cycles and Traits**

SC.3.9.3 Gather and analyze data to communicate an understanding of inheritance and variation of traits though life cycles and environmental influences.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.3.9.3.A **Develop models** to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. Changes organisms go through during their life form a pattern. Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE plants and animals* |
|  | **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.3.9.3.B **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. Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans. Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE plants and animals* |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.9.3.C **Use evidence to support the explanation** that traits can be influenced by the environment. Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE plants, animals, and habitats* |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.9.3.D **Use evidence to construct an explanation** for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE plants, animals, and habitats* |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES | |
| **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.   * Develop models to describe phenomena. (3.9.3.A)   **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.   * Analyze and interpret data to make sense of phenomena using logical reasoning. (3.9.3.B)   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.   * Use evidence (e.g., observations, patterns) to support an explanation. (3.9.3.C) * Use evidence (e.g., observations, patterns) to construct an explanation. (3.9.3.D)   **----------------------------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Scientific Knowledge is Based on Empirical Evidence LS4.B**   * Science findings are based on recognizing patterns. (3.9.3.A) | **Disciplinary Core Ideas**  [**LS1.B**](https://www.nap.edu/read/13165/chapter/10#145)**: Growth and Development of Organisms**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngReproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3.9.3.A)  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**LS3.A**](https://www.nap.edu/read/13165/chapter/10#158)**: Inheritance of Traits**  Many characteristics of organisms are inherited from their parents. (3.9.3.B)   * Other characteristics result from individuals’ interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3.9.3.C)   [**LS3.B**](https://www.nap.edu/read/13165/chapter/10#160)**: Variation of Traits**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngDifferent organisms vary in how they look and function because they have different inherited information. (3.9.3.B)   * The environment also affects the traits that an organism develops. (3.9.3.C)   C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**LS4.B**](https://www.nap.edu/read/13165/chapter/10#163)**: Natural Selection**  Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3.9.3.D) | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png**Patterns**  Similarities and differences in patterns can be used to sort and classify natural phenomena. (3.9.3.B)   * Patterns of change can be used to make predictions. (3.9.3.A)   C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect**  Cause and effect relationships are routinely identified and used to explain change. (3.9.3.C),(3.9.3.D) | |
| *Connections to other DCIs in third grade:* **3.LS4.C** (3.9.3.D) | | | |
| *Articulation of DCIs across grade-levels:***1.LS3.A** (3.9.3.B),(3.9.3.D); **1.LS3.B** (3.9.3.B);**MS.LS1.B** (3.9.3.A), (3.9.3.C); **MS.LS2.A** (3.9.3.D); **MS.LS3.A** (3.9.3.B); **MS.LS3.B** (3.9.3.B),(3.9.3.D); **MS.LS4.B** (3.9.3.D) | | | |
| *NGSS Connections:* [Inheritance and Variation: Life Cycles and Traits](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=13)[**3-LS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=53) (3.9.3.A); [**3-LS3-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=57) (3.9.3.B); [**3-LS3-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=58)(3.9.3.C); [**3-LS4-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=64) (3.9.3.D) | | | |
| *ELA Connections:*  3.1.6.e Determine main ideas and supporting details from informational text and/or media. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.1.6.h Compare and contrast similar themes, topics, and/or patterns of events in literary and informational texts to develop a multicultural perspective. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.1.6.i Construct and/or answer literal and inferential questions and support answers with specific evidence from the text or additional sources. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.1.6.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.2.1.b Generate a draft that develops a clear topic suited to the purpose and intended audience and organizational pattern, including a clear introduction, body, and conclusion with appropriate transitions. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.2.2.a Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.3.1.a Demonstrate appropriate speaking techniques (e.g. appropriate eye contact, adequate volume, clear pronunciation) for a variety of purposes and situations, including interpreting text. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.3.1.c Utilize appropriate visual and/or digital tools to enhance verbal communication and add interest. (3.9.3.A)  3.4.1.a Locate, organize, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (3.9.3.A)  3.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (3.9.3.A) | | | |
| *Mathematics Connections:*  MP.2 Models and represents math problems. (3.9.3.A),(3.9.3.B),(3.9.3.C),(3.9.3.D)  MP.3Communicates mathematical ideas effectively. (3.9.3.B),(3.9.3.C),(3.9.3.D)  3.1.1.c Round a whole number to the tens or hundreds place, using place value understanding or a visual representation. (3.9.3.A)  3.1.1.g Find parts of a whole and parts of a set using visual representations. (3.9.3.A)  3.4.1.aCreate scaled pictographs and scaled bar graphs to represent a data set-including data collected through observations, surveys,   and experiments-with several categories. (3.9.3.D)  3.4.1.b Represent data using line plots where the horizontal scale is marked off in appropriate units-whole numbers, halves, or quarters.   (3.9.3.B),(3.9.3.C)  3.3.3.e Estimate and measure length to the nearest half inch, quarter inch, and centimeter. (3.9.3.B),(3.9.3.C) | | | |
| *Social Studies Connections* | | | |
| *Connections* | | | |

**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **3.9.3.A Develop models** to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and   death. | | |
| 1 | Components of the model | |
| a | Students develop models (e.g., conceptual, physical, drawing) to describe\* the phenomenon. In their models, students identify the relevant components of their models including: |
| 1. Organisms (both plant and animal). |
| 1. Birth. |
| 1. Growth. |
| 1. Reproduction. |
| 1. Death. |
| 2 | Relationships | |
| a | In the models, students describe\* relationships between components, including: |
| 1. Organisms are born, grow, and die in a pattern known as a life cycle. |
| 1. Different organisms’ life cycles can look very different. |
| 1. A causal direction of the cycle (e.g., without birth, there is no growth; without reproduction, there are no births). |
| 3 | Connections | |
| a | Students use the models to describe\* that although organisms can display life cycles that look different, they all follow the same pattern. |
| b | Students use the models to make predictions related to the phenomenon, based on patterns identified among life cycles (e.g., prediction could include that if there are no births, deaths will continue and eventually there will be no more of that type of organism). |

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| **3.9.3.B 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. | | |
| 1 | Organizing data | |
| a | Students organize the data (e.g., from students’ previous work, grade-appropriate existing datasets) using graphical displays (e.g., table, chart, graph). The organized data include: |
| 1. Traits of plant and animal parents. |
| 1. Traits of plant and animal offspring. |
| 1. Variations in similar traits in a grouping of similar organisms. |
| 2 | Identifying relationships | |
| a | Students identify and describe\* patterns in the data, including: |
| 1. Similarities in the traits of a parent and the traits of an offspring (e.g., tall plants typically have tall offspring). |
| 1. Similarities in traits among siblings (e.g., siblings often resemble each other). |
| 1. Differences in traits in a group of similar organisms (e.g., dogs come in many shapes and sizes, a field of corn plants have plants of different heights). |
| 1. Differences in traits of parents and offspring (e.g., offspring do not look exactly like their parents). |
| 1. Differences in traits among siblings (e.g., kittens from the same mother may not look exactly like their mother). |
| 3 | Interpreting data | |
| a | Students describe\* that the pattern of similarities in traits between parents and offspring, and between siblings, provides evidence that traits are inherited. |
| b | Students describe\* that the pattern of differences in traits between parents and offspring, and between siblings, provides evidence that inherited traits can vary. |
| c | Students describe\* that the variation in inherited traits results in a pattern of variation in traits in groups of organisms that are of a similar type. |

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| **3.9.3.C Use evidence to support the explanation** that traits can be influenced by the environment. | | |
| 1 | Articulating the explanation of phenomena | |
| a | Students identify the given explanation to be supported, including a statement that relates the phenomenon to a scientific idea, including that many inherited traits can be influenced by the environment. |
| 2 | Evidence | |
| a | Students describe\* the given evidence that supports the explanation, including: |
| 1. Environmental factors that vary for organisms of the same type (e.g., amount or food, amount of water, amount of exercise an animal gets, chemicals in the water) that may influence organisms’ traits. |
| 1. Inherited traits that vary between organisms of the same type (e.g., height or weight of a plant or animal, color or quantity of the flowers). |
| 1. Observable inherited traits of organisms in varied environmental conditions |
| 3 | Reasoning | |
| a | Students use reasoning to connect the evidence and support an explanation about environmental influences on inherited traits in organisms. In their chain of reasoning, students describe\* a cause-and-effect relationship between a specific causal environmental factor and its effect of a given variation in a trait (e.g., not enough water produces plants that are shorter and have fewer flowers than plants that had more water available). |

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| **3.9.3.D Use evidence to construct an explanation** for how the variations in characteristics among individuals of the same species may provide advantages   in surviving, finding mates, and reproducing. | | |
| 1 | Articulating the explanation of phenomena | |
| a | Students articulate a statement that relates the given phenomenon to a scientific idea, including that variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. |
| b | Students use evidence and reasoning to construct an explanation for the phenomenon. |
| 2 | Evidence | |
| a | Students describe\* the given evidence necessary for the explanation, including: |
| 1. A given characteristic of a species (e.g., thorns on a plant, camouflage of an animal, the coloration of moths). |
| 1. The patterns of variation of a given characteristic among individuals in a species (e.g., longer or shorter thorns on individual plants, dark or light coloration of animals). |
| 1. Potential benefits of a given variation of the characteristic (e.g., the light coloration of some moths makes them difficult to see on the bark of a tree). |
| 3 | Reasoning | |
| a | Students use reasoning to logically connect the evidence to support the explanation for the phenomenon. Students describe\* a chain of reasoning that includes: |
| 1. That certain variations in characteristics make it harder or easier for an animal to survive, find mates, and reproduce (e.g., longer thorns prevent predators more effectively and increase the likelihood of survival; light coloration of some moths provides camouflage in certain environments, making it more likely that they will live long enough to be able to mate and reproduce). |
| 1. That the characteristics that make it easier for some organisms to survive, find mates, and reproduce give those organisms an advantage over other organisms of the same species that don’t have those traits. |
| 1. That there can be a cause-and-effect relationship between a specific variation in a characteristic (e.g., longer thorns, coloration of moths) and its effect on the ability of the individual organism to survive and reproduce (e.g., plants with longer thorns are less likely to be eaten, darker moths are less likely to be seen and eaten on dark trees). |

**SC.3.12 Weather and Climate**

SC.3.12.4 Gather and analyze data to communicate an understanding of weather and climate.

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|  | **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.3.12.4.A **Represent data** in table, pictograph, and bar graph displays to describe typical weather conditions expected during a particular season. Examples of data could include average temperature, precipitation, and wind direction. Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE weather and climate* |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.3.12.4.B **Obtain and combine information** to describe climates in different regions of the world. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.3.12.4.C **Make a claim about the merit of a design solution** that reduces the impacts of a weather-related hazard. Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods. | |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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 tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3.12.4.A)   **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).   * Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3.12.4.C)   **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 other reliable media to explain phenomena. (3.12.4.B) | **Disciplinary Core Ideas**  [**ESS2.D**](https://www.nap.edu/read/13165/chapter/11#186)**: Weather and Climate**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngScientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3.12.4.A)   * Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3.12.4.B)   [**ESS3.B**](https://www.nap.edu/read/13165/chapter/11#192)**: Natural Hazards**   * A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3.12.4.C) *(Note: This Disciplinary Core Idea is also addressed by 4.13.4.D.)* | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png**Patterns**  Patterns of change can be used to make predictions. (3.12.4.A),(3.12.4.B)  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect**  Cause and effect relationships are routinely identified, tested, and used to explain change. (3.12.4.C)  C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png **------------------------------------------**  [***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Influence of Engineering, Technology, and Science on Society and the Natural World**   * Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3.12.4.C)   **--------------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Science is a Human Endeavor**   * Science affects everyday life. (3.12.4.C) |
| *Connections to other DCIs in third grade:* N/A | | |
| *Articulation of DCIs across grade-levels:***K.ESS2.D** (3.12.4.A); **K.ESS3.B** (3.12.4.C); **K.ETS1.A** (3.12.4.C); **4.ESS2.A** (3.12.4.A); **4.ESS3.B** (3.12.4.C); **4.ETS1.A** (3.12.4.C); **5.ESS2.A** (3.12.4.A); **MS.ESS2.C** (3.12.4.A),(3.12.4.B); **MS.ESS2.D** (3.12.4.A),(3.12.4.B); **MS.ESS3.B** (3.12.4.C) | | |
| *NGSS Connections:*  [Weather and Climate](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=14) [**3-ESS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=72) (3.12.4.A); [**3-ESS2-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=73) (3.12.4.B); [**3-ESS3-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=75) (3.12.4.C) | | |
| *ELA Connections:*  3.1.6.i Construct and/or answer literal and inferential questions and support answers with specific evidence from the text or additional sources. (3.12.4.B)  3.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (3.12.4.B)  3.1.6.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (3.12.4.C)  3.2.1.b Generate a draft that develops a clear topic suited to the purpose and intended audience and organizational pattern, including a clear introduction, body, and conclusion with appropriate transitions. (3.12.4.C)  3.2.1.c Gather and use relevant information and evidence from one or more authoritative print and/or digital sources to support claims or theses. (3.12.4.C)  3.2.1.i Display academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (3.12.4.B)  3.2.2.a Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats. (3.12.4.C)  3.2.2.c Conduct and publish research to answer questions or solve problems using multiple resources to support theses. (3.12.4.C)  3.4.1.a Locate, organize, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (3.12.4.C) | | |
| *Mathematics Connections:*  MP.1 Solves mathematical problems. *(3.12.4.A)*  MP.2 Models and represents math problems. (3.12.4.A),(3.12.4.B), *(3.12.4.C)*  MP.3 Communicates mathematical ideas effectively. (3.12.4.A),(3.12.4.B),*(3.12.4.C)*  3.3.3.d Identify and use the appropriate tools and units of measurement, both customary and metric, to solve real-world problems   involving length, weight, mass, liquid volume, and capacity (within the same system and unit). (3.12.4.A)  3.4.1.a Create scaled pictographs and scaled bar graphs to represent a data set-including data collected through observations,   surveys, and experiments-with several categories. (3.12.4.A) | | |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **3.12.4.A Represent data** in table, pictograph, and bar graph displays to describe typical weather conditions expected during a particular season. | | |
| 1 | Organizing data | |
| a | Students use graphical displays (e.g., table, chart, graph) to organize the given data by season using tables, pictographs, and/or bar charts, including: |
| 1. Weather condition data from the same area across multiple seasons (e.g., average temperature, precipitation, wind direction). |
| 1. Weather condition data from different areas (e.g., hometown and nonlocal areas, such as a town in another state). |
| 2 | Identifying relationships | |
| a | Students identify and describe\* patterns of weather conditions across: |
| 1. Different seasons (e.g., cold and dry in the winter, hot and wet in the summer; more or less wind in a particular season). |
| 1. Different areas (e.g., certain areas (defined by location, such as a town in the Pacific Northwest), have high precipitation, while a different area (based on location or type, such as a town in the Southwest) have very little precipitation). |
| 3 | Interpreting data | |
| a | Students use patterns of weather conditions in different seasons and different areas to predict: |
| 1. The typical weather conditions expected during a particular season (e.g., “In our town in the summer it is typically hot, as indicated on a bar graph over time, while in the winter it is typically cold; therefore, the prediction is that next summer it will be hot and next winter it will be cold.”). |
| 1. The typical weather conditions expected during a particular season in different areas. |

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| **3.12.4.B Obtain and combine information** to describe climates in different regions of the world. | | |
| 1 | Obtaining information | |
| a | Students use books and other reliable media to gather information about: |
| 1. Climates in different regions of the world (e.g., equatorial, polar, coastal, mid-continental). |
| 1. Variations in climates within different regions of the world (e.g., variations could include an area’s average temperatures and precipitation during various months over several years or an area’s average rainfall and temperatures during the rainy season over several years). |
| 2 | Evaluating information | |
| a | Students combine obtained information to provide evidence about the climate pattern in a region that can be used to make predictions about typical weather conditions in that region. |
| 3 | Communicating information | |
| a | Students use the information they obtained and combined to describe\*: |
| 1. Climates in different regions of the world. |
| 1. Examples of how patterns in climate could be used to predict typical weather conditions. |
| 1. That climate can vary over years in different regions of the world. |

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| **3.12.4.C Make a claim about the merit of a design solution** that reduces the impacts of a weather-related hazard. | | |
| 1 | Supported claims | |
| a | Students make a claim about the merit of a given design solution that reduces the impact of a weather-related hazard. |
| 2 | Identifying scientific evidence | |
| a | Students describe\* the given evidence about the design solution, including evidence about: |
| 1. The given weather-related hazard (e.g., heavy rain or snow, strong winds, lightning, flooding along river banks). |
| 1. Problems caused by the weather related hazard (e.g., heavy rains cause flooding, lightning causes fires). |
| 1. How the proposed solution addresses the problem (e.g., dams and levees are designed to control flooding, lightning rods reduce the chance of fires) [note: mechanisms are limited to simple observable relationships that rely on logical reasoning]. |
| 3 | Evaluating and critiquing evidence | |
| a | Students evaluate the evidence using given criteria and constraints to determine: |
| 1. How the proposed solution addresses the problem, including the impact of the weather-related hazard after the design solution has been implemented. |
| 1. The merits of a given solution in reducing the impact of a weather-related hazard (i.e., whether the design solution meets the given criteria and constraints]. |
| 1. The benefits and risks a given solution poses when responding to the societal demand to reduce the impact of a hazard. |

**FOURTH GRADE**

The fourth grade standards and indicators help students gather, analyze, and communicate evidence as they formulate answers to questions tailored to student interest and current topics that may include but are not limited to:

**What are waves and what are some of the things they can do?**

Students are able to use a model of waves to describe patterns of waves in

**What is energy and how is it related to motion?**

Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object.

**How is energy transferred?**

Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from object to object through collisions.

**How can energy be used to solve a problem?**

They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another

**How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?**

Students are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, students describe that an object can be seen when light reflected from its surface enters the eye.

**How can water, ice, wind and vegetation change the land?**

Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans.

**What patterns of Earth’s features can be determined with the use of maps?**

In order to describe patterns of Earth’s features, students analyze and interpret data from maps.

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**SC.4.2 Energy: Waves and Information**

SC.4.2.1 Gather, analyze, and communicate evidence of waves and the information they transfer.

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|  | **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.4.2.1.A **Develop a model** of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength. |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.4.2.1.B **Generate and compare multiple solutions** that use patterns to transfer information. |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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.   * Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4.2.1.A)   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.   * Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4.2.1.B)   **-------------------------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Scientific Knowledge is Based on Empirical Evidence**   * Science findings are based on recognizing patterns. (4.2.1.A) | **Disciplinary Core Ideas**  [**PS4.A**](https://www.nap.edu/read/13165/chapter/9?term=PS4.A#131)**: Wave Properties**   * Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. *(Note: This grade band endpoint was moved from K–2)*. (4.2.1.A) * Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4.2.1.A)   [**PS4.C**](https://www.nap.edu/read/13165/chapter/9?term=PS4.A#136)**: Information Technologies and Instrumentation**   * Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4.2.1.B)   [**ETS1.C**](https://www.nap.edu/read/13165/chapter/12#208)**: Optimizing The Design Solution**  Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. *(secondary to 4.2.1.B)* | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png**Patterns**  Similarities and differences in patterns can be used to sort and classify natural phenomena. (4.2.1.A)   * Similarities and differences in patterns can be used to sort and classify designed products. (4.2.1.B)   C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png**--------------------------------------**  [***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Interdependence of Science, Engineering, and Technology**   * Knowledge of relevant scientific concepts and research findings is important in engineering. (4.2.1.B) |

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| *Connections to other DCIs in fourth grade:* **4.PS3.A** (4.2.1.A); **4.PS3.B** (4.2.1.A); **4.ETS1.A** (4.2.1.B) |
| *Articulation of DCIs across grade-levels:***K.ETS1.A** (4.2.1.B); **1.PS4.C** (4.2.1.B); **2.ETS1.B** (4.2.1.B); **2.ETS1.C** (4.2.1.B); **3.PS2.A** (4.2.1.B); **MS.PS4.A** (4.2.1.A); **MS.PS4.C** (4.2.1.B); **MS.ETS1.B** (4.2.1.B) |
| *NGSS Connections:*  [Waves: Waves and Information](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=16)[**4-PS4-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=80)(4.2.1.A); [**4-PS4-3**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=82) (4.2.1.B) |
| *ELA Connections:*  4.1.6.i Construct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources. (4.2.1.B)  4.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (4.2.1.B)  4.1.6.n Make and confirm/modify predictions and inferences before, during, and after reading literary, informational, digital text, and/or media. (4.2.1.B)  4.3.1.c Utilize appropriate visual and/or digital tools to enhance verbal communication and add interest. (4.2.1.A)  4.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (4.2.1.A) |
| *Mathematics Connections:*  MP.2 Models and represents math problems. (4.2.1.A)  4.3.1.b Classify an angle as acute, obtuse, or right. (4.2.1.A)  4.3.1.c Identify and draw points, lines, line segments, rays, angles, parallel lines, perpendicular lines, and intersecting lines, and recognize them in two-dimensional figures.   (4.2.1.A) |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **4.2.1.A Develop a model** of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. | | |
| 1 | Components of the model | |
| a | Students develop a model (e.g., diagrams, analogies, examples, abstract representations, physical models) to make sense of a phenomenon that involves wave behavior. In the model, students identify the relevant components, including: |
| 1. Waves. |
| 1. Wave amplitude. |
| 1. Wavelength. |
| 1. Motion of objects. |
| 2 | Relationships | |
| a | Students identify and describe\* the relevant relationships between components of the model, including: |
| 1. Waves can be described\* in terms of patterns of repeating amplitude and wavelength (e.g., in a water wave there is a repeating pattern of water being higher and then lower than the baseline level of the water). |
| 1. Waves can cause an object to move. |
| 1. The motion of objects varies with the amplitude and wavelength of the wave carrying it. |
| 3 | Connections | |
| a | Students use the model to describe\*: |
| 1. The patterns in the relationships between a wave passing, the net motion of the wave, and the motion of an object caused by the wave as it passes. |
| 1. How waves may be initiated (e.g., by disturbing surface water or shaking a rope or spring). |
| 1. The repeating pattern produced as a wave is propagated. |
| b | Students use the model to describe\* that waves of the same type can vary in terms of amplitude and wavelength and describe\* how this might affect the motion, caused by a wave, of an object. |
| c | Students identify similarities and differences in patterns underlying waves and use these patterns to describe\* simple relationships involving wave amplitude, wavelength, and the motion of an object (e.g., when the amplitude increases, the object moves more). |

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| **4.2.1.B Generate and compare multiple solutions** that use patterns to transfer information. | | |
| 1 | Using scientific knowledge to generate design solutions | |
| a | Students generate at least two design solutions, for a given problem, that use patterns to transmit a given piece of information (e.g., picture, message). Students describe\* how the design solution is based on: |
| 1. Knowledge of digitized information transfer (e.g., information can be converted from a sound wave into a digital signal such as patterns of 1s and 0s and vice versa; visual or verbal messages can be encoded in patterns of flashes of light to be decoded by someone else across the room). |
| 1. Ways that high-tech devices convert and transmit information (e.g., cell phones convert sound waves into digital signals, so they can be transmitted long distances, and then converted back into sound waves; a picture or message can be encoded using light signals to transmit the information over a long distance). |
| 2 | Describing\* criteria and constraints, including quantification when appropriate | |
| a | Students describe\* the given criteria for the design solutions, including the accuracy of the final transmitted information and that digitized information (patterns) transfer is used. |
| b | Students describe\* the given constraints of the design solutions, including: |
| 1. The distance over which information is transmitted. |
| 1. Safety considerations. |
| 1. Materials available. |
| 3 | Evaluating potential solutions | |
| a | Students compare the proposed solutions based on how well each meets the criteria and constraints. |
| b | Students identify similarities and differences in the types of patterns used in the solutions to determine whether some ways of transmitting information are more effective than others at addressing the problem. |

**SC.4.4 Energy: Conservation and Transfer**

SC.4.4.2 Gather, analyze and communicate evidence of energy conservation and transfer.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png | SC.4.4.2.A Use evidence to **construct an explanation** relating the speed of an object to the energy of that object. Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy. | |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png | SC.4.4.2.B **Make observations** to provide evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents. Assessment does not include quantitative measurements of energy. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE energy producers* |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png | SC.4.4.2.C **Ask questions** and predict outcomes about the changes in energy that occur when objects collide. Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. Assessment does not include quantitative measurements of energy. | |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png | SC.4.4.2.D Apply scientific ideas to **design, test, and refine a device** that converts energy from one form to another. Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device. Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound. | |
|  |  |  | SC.4.4.2.E **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. | |
|  | **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.4.4.2.F **Obtain and combine information** to describe that energy and fuels are derived from natural resources and that their uses affect the environment. Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE ethanol production* |  |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **Science and Engineering Practices**  **Asking Questions and Defining Problems**  Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.   * Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4.4.2.C)   **Planning and Carrying Out Investigations**  Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.   * Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4.4.2.B) * 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. (4.4.2.E)   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.   * Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4.4.2.A) * Apply scientific ideas to solve design problems. (4.4.2.D)   **Obtaining, Evaluating, and Communicating Information**  Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods.   * Obtain and combine information from books and other reliable media to explain phenomena. (4.4.2.F) | **Disciplinary Core Ideas**  [**PS3.A**](https://www.nap.edu/read/13165/chapter/9?term=PS3.#120)**: Definitions of Energy**   * The faster a given object is moving, the more energy it possesses. (4.4.2.A) * Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4.4.2.B),(4.4.2.C)   [**PS3.B**](https://www.nap.edu/read/13165/chapter/9#105)**: Conservation of Energy and Energy Transfer**   * Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4.4.2.B),(4.4.2.C) * Light also transfers energy from place to place. (4.4.2.B)   C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngEnergy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical   energy. (4.4.2.B),(4.4.2.D)  [**PS3.C**](https://www.nap.edu/read/13165/chapter/9#126)**: Relationship Between Energy and Forces**   * When objects collide, the contact forces transfer energy so as to change the objects’ motions. (4.4.2.C)   [**PS3.D**](https://www.nap.edu/read/13165/chapter/9?term=PS3.#128)**: Energy in Chemical Processes and Everyday Life**   * The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4.4.2.D)   [**ETS1.A**](https://www.nap.edu/read/13165/chapter/12#204)**: Defining Engineering Problems**   * Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary to 4.4.2.D)*   [**ETS1.B**](https://www.nap.edu/read/13165/chapter/12#206)**: Developing Possible Solutions**  Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (4.4.2.E)  [**ETS1.C**](https://www.nap.edu/read/13165/chapter/12#208)**: Optimizing the Design Solution**  Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (4.4.2.E)  [**ESS3.A**](https://www.nap.edu/read/13165/chapter/11?term=ESS3.A#192)**: Natural Resources**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.pngEnergy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4.4.2.F) | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect** Cause and effect relationships are routinely identified and used to explain change. (4.4.2.F)  C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png**Energy and Matter**  Energy can be transferred in various ways and between objects. (4.4.2.A),(4.4.2.B),(4.4.2.C), (4.4.2.D)  C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png**--------------------------------------------**  [***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Interdependence of Science, Engineering, and Technology**   * Knowledge of relevant scientific concepts and research findings is important in engineering. (4.4.2.F)   **Influence of Engineering, Technology, and Science on Society and the Natural World**   * Over time, people’s needs and wants change, as do their demands for new and improved technologies. (4.4.2.F) * Engineers improve existing technologies or develop new ones. (4.4.2.D)   **-----------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Science is a Human Endeavor**   * Most scientists and engineers work in teams. (4.4.2.D) * Science affects everyday life. (4.4.2.D) |
| *Connections to other DCIs in fourth grade:* N/A | | |
| *Articulation of DCIs across grade-levels:***K.PS2.B** (4.4.2.C); **K.ETS1.A** (4.4.2.D); **2.ETS1.B** (4.4.2.D); **3.PS2.A** (4.4.2.C); **5.PS3.D** (4.4.2.D); **5.LS1.C** (4.4.2.D); **5.ESS3.C** (4.4.2.F); **MS.PS2.A** (4.4.2.C); **MS.PS2.B** (4.4.2.B); **MS.PS3.A** (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D); **MS.PS3.B** (4.4.2.B),(4.4.2.C),(4.4.2.D); **MS.PS3.C** (4.4.2.C); **MS.PS3.D** (4.4.2.F); **MS.PS4.B** (4.4.2.B); **MS.ESS2.A** (4.4.2.F); **MS.ESS3.A** (4.4.2.F); **MS.ESS3.C** (4.4.2.F); **MS.ESS3.D** (4.4.2.F); **MS.ETS1.B** (4.4.2.D); **MS.ETS1.C** (4.4.2.D) | | |
| *NGSS Connections:* [Energy](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=15) [**4-PS3-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=76) (4.4.2.A); [**4-PS3-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=77) (4.4.2.B); [**4-PS3-3**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=78)(4.4.2.C); [**4-PS3-4**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=79) (4.4.2.D); [**4-ESS3-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=93) (4.4.2.F) [Engineering Design](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=23) [**3-5-ETS1-3**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=128) (4.4.2.E) | | |
| *ELA Connections:*  4.1.6.i Construct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources. (4.4.2.A)  4.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (4.4.2.A)  4.1.6.n Make and confirm/modify predictions and inferences before, during, and after reading literary, informational, digital text, and/or media. (4.4.2.A)  4.1.6.oDemonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (4.4.2.A)  4.2.1.cGather and use relevant information and evidence from multiple authoritative print and/or digital sources to support claims or theses. (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D),(4.4.2.F)  4.2.1.iDisplay academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D),(4.4.2.F)  4.4.2.b Use appropriate digital tools (e.g., social media, online collaborative tools, apps) to communicate with others for conveying information, gathering opinions, and solving problems. (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D),(4.4.2.F)  4.2.2.c Conduct and publish research projects to answer questions or solve problems using multiple resources to support theses. (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D),(4.4.2.F)  4.4.1.a Locate, organize, analyze, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D),(4.4.2.F)  4.4.1.b Demonstrate ethical use of information and copyright guidelines by appropriately quoting or paraphrasing from a text and citing the source using available resources (e.g., online citation tools). (4.4.2.A),(4.4.2.B),(4.4.2.C),(4.4.2.D),(4.4.2.F) | | |
| *Mathematics Connections:*  MP.2 Models and represents math problems. (4.4.2.F)  MP.3 Communicates mathematical ideas effectively. (4.4.2.F)  4.2.2.a Solve one- and two-step problems which use any or all of the four basic operations and include the use of a letter to represent the   unknown quantity. (4.4.2.D)  4.2.3.a Solve real-world problems involving multi-step equations comprised of whole numbers using the four operations, including   interpreting remainders. (4.4.2.D) | | |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **4.4.2.A** Use evidence to **construct an explanation** relating the speed of an object to the energy of that object. | | |
| 1 | Articulating the explanation of phenomena | |
| a | Students articulate a statement that relates the given phenomenon to a scientific idea, including that the speed of a given object is related to the energy of the object (e.g., the faster an object is moving, the more energy it possesses). |
| b | Students use the evidence and reasoning to construct an explanation for the phenomenon. |
| 2 | Evidence | |
| a | Students identify and describe\* the relevant given evidence for the explanation, including: |
| 1. The relative speed of the object (e.g., faster vs. slower objects). |
| 1. Qualitative indicators of the amount of energy of the object, as determined by a transfer of energy from that object (e.g., more or less sound produced in a collision, more or less heat produced when objects rub together, relative speed of a ball that was stationary following a collision with a moving object, more or less distance a stationary object is moved). |
| 3 | Reasoning | |
| a | Students use reasoning to connect the evidence to support an explanation for the phenomenon. In the explanation, students describe\* a chain of reasoning that includes: |
| 1. Motion can indicate the energy of an object. |
| 1. The faster a given object is moving, the more observable impact it can have on another object (e.g., a fast-moving ball striking something (a gong, a wall) makes more noise than does the same ball moving slowly and striking the same thing). |
| 1. The observable impact of a moving object interacting with its surroundings reflects how much energy was able to be transferred between objects and therefore relates to the energy of the moving object. |
| 1. Because faster objects have a larger impact on their surroundings than objects moving more slowly, they have more energy due to motion (e.g., a fast-moving ball striking a gong makes more noise than a slow-moving ball doing the same thing because it has more energy that can be transferred to the gong, producing more sound). [Note: This refers only to relative bulk motion energy, not potential energy, to remain within the DCI.] |
| 1. Therefore, the speed of an object is related to the energy of the object. |

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| **4.4.2.B Make observations** to provide evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents. | | |
| 1 | Identifying the phenomenon under investigation | |
| a | From the given investigation plan, students describe\* the phenomenon under investigation, which includes the following ideas: |
| 1. The transfer of energy, including: |
| 1. Collisions between objects. |
| 1. Light traveling from one place to another. |
| 1. Electric currents producing motion, sound, heat, or light. |
| 1. Sound traveling from one place to another. |
| 1. Heat passing from one object to another. |
| 1. Motion, sound, heat, and light causing a different type of energy to be observed after an interaction (e.g., in a collision between two objects, one object may slow down or stop, the other object may speed up, and the objects and surrounding air may be heated; a specific sound may cause the movement of an object; the energy associated with the motion of an object, via an electrical current, may be used to turn on a light). |
| b | Students describe\* the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon, including the idea that energy can be transferred from place to place by: |
| 1. Moving objects. |
| 1. Sound. |
| 1. Light. |
| 1. Heat. |
| 1. Electric currents. |
| 2 | Identifying the evidence to address the purpose of the investigation | |
| a | From the given investigation plan, students describe\* the data to be collected that will serve as the basis for evidence, including: |
| 1. The motion and collision of objects before and after an interaction (e.g., when a given object is moving fast, it can move another object farther than when the same object is moving more slowly). |
| 1. The relative presence of sound, light, or heat (including in the surrounding air) before and after an interaction (e.g. shining a light on an object can increase the temperature of the object; a sound can move an object). |
| 1. The presence of electric currents flowing through wires causally linking one form of energy output (e.g., a moving object) to another form of energy output (e.g., another moving object; turning on a light bulb). |
| b | Students describe\* how their observations will address the purpose of the investigation, including how the observations will provide evidence that energy, in the form of light, sound, heat, and motion, can be transferred from place to place by sound, light, heat, or electric currents (e.g., in a system in which the motion of an object generates an observable electrical current to turn on a light, energy (from the motion of an object) must be transferred to another place (energy in the form of the light bulb) via the electrical current, because the motion doesn’t cause the light bulb to light up if the wire is not completing a circuit between them; when a light is directed at an object, energy (in the form of light) must be transferred from the source of the light to its destination and can be observed in the form of heat, because if the light is blocked, the object isn’t warmed. |
| 3 | Planning the investigation | |
| a | From the given investigation plan, students identify and describe\* how the data will be observed and recorded, including the tools and methods for collecting data on: |
| 1. The motion and collision of objects, including any sound or heat producing the motion/collision, or produced by the motion/collision. |
| 1. The presence of energy in the form of sound, light, or heat in one place as a result of sound, light, or heat in a different place. |
| 1. The presence of electric currents in wires and the presence of energy (in the form of sound, light, heat, or motion resulting from the flow of electric currents through a device). |
| b | Students describe\* the number of trials, controlled variables, and experimental set up. |
| 4 | Collecting the data | |
| a | Students make and record observations according to the given investigation plan to provide evidence that: |
| 1. Energy is present whenever there are moving objects, sound, light, or heat. |
| 1. That energy has been transferred from place to place (e.g., a bulb in a circuit is not lit until a switch is closed and it lights, indicating that energy is transferred through electric current in a wire to light the bulb; a stationary ball is struck by a moving ball, causing the stationary ball to move and the moving ball to slow down, indicating that energy has been transferred from the moving ball to the stationary one). |

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| **4.4.2.C Ask questions** and predict outcomes about the changes in energy that occur when objects collide. | | |
| 1 | Addressing phenomena of the natural world | |
| a | Students ask questions about the changes in energy that occur when objects collide, the answers to which would clarify: |
| 1. A qualitative measure of energy (e.g., relative motion, relative speed, relative brightness) of the object before the collision. |
| 1. The mechanism of energy transfer during the collision, including: |
| 1. The transfer of energy by contact forces between colliding objects that results in a change in the motion of the objects. |
| 1. The transfer of energy to the surrounding air when objects collide resulting in sound and heat. |
| b | Students predict reasonable outcomes about the changes in energy that occur after objects collide, based on patterns linking object collision and energy transfer between objects and the surrounding air. |
| 2 | Identifying the scientific nature of the question | |
| a | Students ask questions that can be investigated within the scope of the classroom or an outdoor environment. |

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| **4.4.2.D** Apply scientific ideas to **design, test, and refine a device** that converts energy from one form to another. | | |
| 1 | Using scientific knowledge to generate design solutions | |
| a | Given a problem to solve, students collaboratively design a solution that converts energy from one form to another. In the design, students: |
| 1. Specify the initial and final forms of energy (e.g., electrical energy, motion, light). |
| 1. Identify the device by which the energy will be transformed (e.g., a light bulb to convert electrical energy into light energy, a motor to convert electrical energy into energy of motion). |
| 2 | Describing\* criteria and constraints, including quantification when appropriate | |
| a | Students describe\* the given criteria and constraints of the design, which include: |
| 1. Criteria: |
| 1. The initial and final forms of energy. |
| 1. Description\* of how the solution functions to transfer energy from one form to another. |
| 1. Constraints: |
| 1. The materials available for the construction of the device. |
| 1. Safety considerations. |
| 3 | Evaluating potential solutions | |
| a | Students evaluate the proposed solution according to how well it meets the specified criteria and constraints of the problem. |
| 4 | Modifying the design solution | |
| a | Students test the device and use the results of the test to address problems in the design or improve its functioning. |

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| **4.4.2.E 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. | | |
| 1 | Identifying the purpose of the investigation | |
| a | Students describe\* the purpose of the investigation, which includes finding possible failure points or difficulties to identify aspects of a model or prototype that can be improved. |
| 2 | Identifying the evidence to be address the purpose of the investigation | |
| a | Students describe\* the evidence to be collected, including: |
| 1. How well the model/prototype performs against the given criteria and constraints. |
| 1. Specific aspects of the prototype or model that do not meet one or more of the criteria or constraints (i.e., failure points or difficulties). |
| 1. Aspects of the model/prototype that can be improved to better meet the criteria and constraints. |
| b | Students describe\* how the evidence is relevant to the purpose of the investigation. |
| 3 | Planning the investigation | |
| a | Students create a plan for the investigation that describes\* different tests for each aspect of the criteria and constraints. For each aspect, students describe\*: |
| 1. The specific criterion or constraint to be used. |
| 1. What is to be changed in each trial (the independent variable). |
| 1. The outcome (dependent variable) that will be measured to determine success. |
| 1. What tools and methods are to be used for collecting data. |
| 1. What is to be kept the same from trial to trial to ensure a fair test. |
| 4 | Collecting the data | |
| a | Students carry out the investigation, collecting and recording data according to the developed plan. |

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| **4.4.2.F Obtain and combine information** to describe that energy and fuels are derived from natural resources and that their uses affect the environment. | | |
| 1 | Obtaining information | |
| a | Students gather information from books and other reliable media about energy resources and fossil fuels (e.g., fossil fuels, solar, wind, water, nuclear), including: |
| 1. How they are derived from natural sources (e.g., which natural resource they are derived from) [note: mechanisms should be limited to grade appropriate descriptions\*, such as comparing the different ways energy resources are each derived from a natural resource). |
| 1. How they address human energy needs. |
| 1. The positive and negative environmental effects of using each energy resource. |
| 2 | Evaluating information | |
| a | Students combine the obtained information to provide evidence about: |
| 1. The effects on the environment of using a given energy resource. |
| 1. Whether the energy resource is renewable. |
| 1. The role of technology, including new and improved technology, in improving or mediating the environmental effects of using a given resource. |
| 3 | Communicating information | |
| a | Students use the information they obtained and combined to describe\* the causal relationships between: |
| 1. Energy resources and the environmental effects of using that energy source. |
| 1. The role of technology in extracting and using an energy resource. |

**SC.4.6 Structure, Function, and Information Processing**

SC.4.6.3 Gather and analyze data to communicate an understanding of structure, function and information processing of living things.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | | SC.4.6.3.A **Develop a model** to describe that light reflecting from objects and entering the eyes allows objects to be seen.   Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works. | |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png | SC.4.6.3.B **Construct an argument** that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin. Assessment is limited to macroscopic structures within plant and animal systems. | | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | | *NE plants and animals* |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png | SC.4.6.3.C **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. Emphasis is on systems of information transfer. Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function. | | |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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.   * Develop a model to describe phenomena. (4.6.3.A) * Use a model to test interactions concerning the functioning of a natural system. (4.6.3.C)   **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).   * Construct an argument with evidence, data, and/or a model. (4.6.3.B) | **Disciplinary Core Ideas**  [**PS4.B**](https://www.nap.edu/read/13165/chapter/9?term=PS4.A#133)**: Electromagnetic Radiation**   * An object can be seen when light reflected from its surface enters the eyes. (4.6.3.A)   C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**LS1.A**](https://www.nap.edu/read/13165/chapter/10#143)**: Structure and Function**  Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4.6.3.B)  [**LS1.D**](https://www.nap.edu/read/13165/chapter/10#148)**: Information Processing**   * Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal’s brain. Animals are able to use their perceptions and memories to guide their actions. (4.6.3.C) | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect**  Cause and effect relationships are routinely identified. (4.6.3.A)  C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png**Systems and System Models**  A system can be described in terms of its components and their interactions. (4.6.3.B), (4.6.3.C) |

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| *Connections to other DCIs in this grade-level:* N/A |
| *Articulation of DCIs across grade-levels:* 1.PS4.B (4.6.3.A); 1.LS1.A (4.6.3.B); 1.LS1.D (4.6.3.C); 3.LS3.B (4.6.3.B); MS.PS4.B (4.6.3.A); MS.LS1.A (4.6.3.B),(4.6.3.C); MS.LS1.D (4.6.3.A),(4.6.3.C) |
| *NGSS Connections:* [Structure Function, and Information Processing](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=17) [**4-PS4-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=81) (4.6.3.A); [**4-LS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=70) (4.6.3.B); [**4-LS1-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=71) (4.6.3.C) |
| *ELA Connections:*  4.1.6.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (4.6.3.B)  4.2.1.b Generate a draft that develops a clear topic suited to the purpose and intended audience and organizational pattern, including a clear introduction, body, and conclusion with appropriate transitions. (4.6.3.B)  4.2.2.a Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats. (4.6.3.B)  4.3.1.c Utilize appropriate visual and/or digital tools to enhance verbal communication and add interest. (4.6.3.A),(4.6.3.C)  4.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (4.6.3.A),(4.6.3.C) |
| *Mathematics Connections:*  MP.2 Models and represents math problems. *(4.6.3.A)*  4.3.1.b Classify an angle as acute, obtuse, or right. *(4.6.3.A)*  4.3.1.c Identify and draw points, lines, line segments, rays, angles, parallel lines, perpendicular lines, and intersecting lines, and recognize them in two-dimensional figures. *(4.6.3.A)*  4.3.1.h Recognize and draw lines of symmetry in two-dimensional shapes. *(4.6.3.B)* |
| *Connections:* |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **4.6.3.A Develop a model** to describe that light reflecting from objects and entering the eyes allows objects to be seen. | | |
| 1 | Components of the model | |
| a | Students develop a model to make sense of a phenomenon involving the relationship between light reflection and visibility of objects. In the model, students identify the relevant components, including: |
| 1. Light (including the light source). |
| 1. Objects. |
| 1. The path that light follows. |
| 1. The eye. |
| 2 | Relationships | |
| a | Students identify and describe\* causal relationships between the components, including: |
| 1. Light enters the eye, allowing objects to be seen. |
| 1. Light reflects off of objects, and then can travel and enter the eye. |
| 1. Objects can be seen only if light follows a path between a light source, the object, and the eye. |
| 3 | Connections | |
| a | Students use the model to describe\* that in order to see objects that do not produce their own light, light must reflect off the object and into the eye. |
| b | Students use the model to describe\* the effects of the following on seeing an object: |
| 1. Removing, blocking, or changing the light source (e.g., a dimmer light). |
| 1. Closing the eye. |
| 1. Changing the path of the light (e.g., using mirrors to direct the path of light to allow the visualization of a previously unseen object or to change the position in which the object can be seen, using an opaque or translucent barrier between 1) the light source and the object or 2) the object and the eye to change the path light follows and the visualization of the object). |

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| **4.6.3.B Construct an argument** that plants and animals have internal and external structures that function to support survival, growth, behavior, and   reproduction. | | |
| 1 | Supported claims | |
| a | Students make a claim to be supported about a phenomenon. In the claim, students include the idea that plants and animals have internal and external structures that function together as part of a system to support survival, growth, behavior, and reproduction. |
| 2 | Identifying scientific evidence | |
| a | Students describe\* the given evidence, including: |
| 1. The internal and external structures of selected plants and animals. |
| 1. The primary functions of those structures |
| 3 | Evaluating and critiquing evidence | |
| a | Students determine the strengths and weaknesses of the evidence, including whether the evidence is relevant and sufficient to support a claim about the role of internal and external structures of plants and animals in supporting survival, growth, behavior, and/or reproduction. |
| 4 | Reasoning and synthesis | |
| a | Students use reasoning to connect the relevant and appropriate evidence and construct an argument that includes the idea that plants and animals have structures that, together, support survival, growth, behavior, and/or reproduction. Students describe\* a chain of reasoning that includes: |
| 1. Internal and external structures serve specific functions within plants and animals (e.g., the heart pumps blood to the body, thorns discourage predators). |
| 1. The functions of internal and external structures can support survival, growth, behavior, and/or reproduction in plants and animals (e.g., the heart pumps blood throughout the body, which allows the entire body access to oxygen and nutrients; thorns prevent predation, which allows the plant to grow and reproduce). |
| 1. Different structures work together as part of a system to support survival, growth, behavior, and/or reproduction (e.g., the heart works with the lungs to carry oxygenated blood throughout the system; thorns protect the plant, allowing reproduction via stamens and pollen to occur). |

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| **4.6.3.C 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. | | |
| 1 | Components of the model | |
| a | From a given model, students identify and describe\* the relevant components for testing interactions concerning the functioning of a given natural system, including: |
| 1. Different types of information about the surroundings (e.g., sound, light, odor, temperature). |
| 1. Sense receptors able to detect different types of information from the environment. |
| 1. Brain. |
| 1. Animals’ actions. |
| 2 | Relationships | |
| a | Students describe\* the relationships between components in the model, including: |
| 1. Different types of sense receptors detect specific types of information within the environment. |
| 1. Sense receptors send information about the surroundings to the brain. |
| 1. Information that is transmitted to the brain by sense receptors can be processed immediately as perception of the environment and/or stored as memories. |
| 1. Immediate perceptions or memories processed by the brain influence an animal’s action or responses to features in the environment. |
| 3 | Connections | |
| a | Students use the model to describe\* that: |
| 1. Information in the environment interacts with animal behavioral output via interactions mediated by the brain. |
| 1. Different types of sensory information are relayed to the brain via different sensory receptors, allowing experiences to be perceived, stored as memories, and influence behavior (e.g., an animal sees a brown, rotten fruit and smells a bad odor — this sensory information allows the animal to use information about other fruits that appear to be rotting to make decisions about what to eat; an animal sees a red fruit and a green fruit — after eating them both, the animal learns that the red fruit is sweet and the green fruit is bitter and then uses this sensory information, perceived and stored as memories, to guide fruit selection next time). |
| 1. Sensory input, the brain, and behavioral output are all parts of a system that allow animals to engage in appropriate behaviors. |
| b | Students use the model to test interactions involving sensory perception and its influence on animal behavior within a natural system, including interactions between: |
| 1. Information in the environment. |
| 1. Different types of sense receptors. |
| 1. Perception and memory of sensory information. |
| 1. Animal behavior. |

**SC.4.13 Earth's Systems: Processes That Shape the Earth**

SC.4.13.4 Gather and analyze data to communicate an understanding of Earth's systems and processes that shape the Earth.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.4.13.4.A **Identify evidence** from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock. Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE fossils and geologic history* |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.4.13.4.B **Make observations and/or measurements** to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow. Assessment is limited to a single form of weathering or erosion. | |
| **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.4.13.4.C **Analyze and interpret data** from maps to describe patterns of Earth's features. Maps can include topographic maps of Earth’s land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.4.13.4.D **Generate and compare multiple solutions** to reduce the impacts of natural Earth processes on humans. Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity. Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions. | |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **Science and Engineering Practices**  **Planning and Carrying Out Investigations**  Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.   * Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4.13.4.B)   **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.   * Analyze and interpret data to make sense of phenomena using logical reasoning. (4.13.4.C)   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.   * Identify the evidence that supports particular points in an explanation. (4.13.4.A) * Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4.13.4.D) | **Disciplinary Core Ideas**  [**ESS1.C**](https://www.nap.edu/read/13165/chapter/11#177)**: The History of Planet Earth**   * Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4.13.4.A)   [**ESS2.A**](https://www.nap.edu/read/13165/chapter/11#180)**: Earth Materials and Systems**   * Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4.13.4.B)   [**ESS2.B**](https://www.nap.edu/read/13165/chapter/11#182)**: Plate Tectonics and Large-Scale System Interactions**   * The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4.13.4.C)   [**ESS2.E**](https://www.nap.edu/read/13165/chapter/11#189)**: Biogeology**   * Living things affect the physical characteristics of their regions. (4.13.4.B)   [**ESS3.B**](https://www.nap.edu/read/13165/chapter/11#192)**: Natural Hazards**   * A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4.13.4.D) *(Note: This Disciplinary Core Idea can also be found in 3.WC.)*   [**ETS1.B**](https://www.nap.edu/read/13165/chapter/12#206)**: Designing Solutions to Engineering Problems**   * Testing a solution involves investigating how well it performs under a range of likely conditions. *(secondary to 4.13.4.D)* | **Crosscutting Concepts**  **Patterns**  C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.pngPatterns can be used as evidence to support an explanation. (4.13.4.A),(4.13.4.C)  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect**  Cause and effect relationships are routinely identified, tested, and used to explain change. (4.13.4.B),(4.13.4.D)  C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png**------------------------------------**  [***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Influence of Engineering, Technology, and Science on Society and the Natural World**   * Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4.13.4.D)   **--------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Scientific Knowledge Assumes an Order and Consistency in Natural Systems**   * Science assumes consistent patterns in natural systems. (4.13.4.A) |
| *Connections to other DCIs in fourth grade:* **4.ETS1.C** (4.13.4.D) | | |
| *Articulation of DCIs across grade-levels:***K.ETS1.A** (4.13.4.D); **2.ESS1.C** (4.13.4.A),(4.13.4.B); **2.ESS2.A** (4.13.4.B); **2.ESS2.B** (4.13.4.C); **2.ESS2.C** (4.13.4.C); **2.ETS1.B** (4.13.4.D); **2.ETS1.C** (4.13.4.D); **3.LS4.A** (4.13.4.A); **5.ESS2.A** (4.13.4.B); **5.ESS2.C** (4.13.4.C); **MS.LS4.A** (4.13.4.A); **MS.ESS1.C** (4.13.4.A),(4.13.4.C); **MS.ESS2.A** (4.13.4.A),(4.13.4.C),(4.13.4.D); **MS.ESS2.B** (4.13.4.A),(4.13.4.C); **MS.ESS3.B** (4.13.4.D); **MS.ETS1.B** (4.13.4.D) | | |
| *NGSS Connections:* [Earth's Systems: Processes That Shape the Earth](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=18)[**4-ESS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=74) (4.13.4.A); [**4-ESS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=83) (4.13.4.B); [**4-ESS2-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=84) (4.13.4.C); [**4-ESS3-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=94)(4.13.4.D) | | |
| *ELA Connections:*  4.1.4.b Demonstrate ethical use of information and copyright guidelines by appropriately quoting or paraphrasing from a text and citing the source using available resources (e.g., online citation tools). (4.13.4.A),(4.13.4.B)4.1.6.n Make and confirm/modify predictions and inferences before, during, and after reading literary, informational, digital text, and/or media. (4.13.4.D)  4.1.6.i Construct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources. (4.13.4.D)  4.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (4.13.4.D)  4.2.1.c Gather and use relevant information and evidence from multiple authoritative print and/or digital sources to support claims or theses. (4.13.4.A),(4.13.4.B)  4.2.1.i Display academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (4.13.4.A),(4.13.4.B)  4.2.2.b Provide evidence from literary or informational text to support analysis, reflection, and research. (4.13.4.A),(4.13.4.B)  4.2.2.c Conduct and publish research projects to answer questions or solve problems using multiple resources to support theses. (4.13.4.A),(4.13.4.B)  4.4.1.a  Locate, organize, analyze, and evaluate information from print and digital resources to generate and answer questions and create   new understandings. (4.13.4.A),(4.13.4.B),(4.13.4.C)  4.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (4.13.4.C) | | |
| *Mathematics Connections:*  MP.1 Solves mathematical problems. (4.13.4.B)  MP.2 Models and represents math problems. (4.13.4.A),(4.13.4.B),(4.13.4.D)  MP.3 Communicates mathematical ideas effectively. (4.13.4.A),(4.13.4.B),(4.13.4.D)  4.3.3.c Generate simple conversions from a larger unit to a smaller unit within the customary and metric systems of measurement. (4.13.4.A),(4.13.4.B)  4.3.3.b Identify and use the appropriate tools, operations, and units of measurement, both customary and metric, to solve real-world problems involving time, length, weight, mass, capacity, and volume. (4.13.4.B),(4.13.4.C) | | |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **4.13.4.A Identify evidence** from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. | | |
| 1 | Articulating the explanation of phenomena | |
| a | Students identify the given explanation for a phenomenon, which includes a statement about the idea that landscapes change over time. |
| b | From the given explanation, students identify the specific aspects of the explanation they are supporting with evidence. |
| 2 | Evidence | |
| a | Students identify the evidence relevant to supporting the explanation, including local and regional patterns in the following: |
| 1. Different rock layers found in an area (e.g., rock layers taken from the same location show marine fossils in some layers and land fossils in other layers). |
| 1. Ordering of rock layers (e.g., layer with marine fossils is found below layer with land fossils). |
| 1. Presence of particular fossils (e.g., shells, land plants) in specific rock layers. |
| 1. The occurrence of events (e.g., earthquakes) due to Earth forces. |
| 3 | Reasoning | |
| a | Students use reasoning to connect the evidence to support particular points of the explanation, including the identification of a specific pattern of rock layers and fossils (e.g., a rock layer containing shells and fish below a rock layer containing fossils of land animals and plants is a pattern indicating that, at one point, the landscape had been covered by water and later it was dry land). Students describe\* reasoning for how the evidence supports particular points of the explanation, including: |
| 1. Specific rock layers in the same location show specific fossil patterns (e.g., some lower rock layers have marine fossils, while some higher rock layers have fossils of land plants). |
| 1. Since lower layers were formed first then covered by upper layers, this pattern indicates that the landscape of the area was transformed into the landscape indicated by the upper layer (e.g., lower marine fossils indicate that, at one point, the landscape was covered by water, and upper land fossils indicate that later the landscape was dry land). |
| 1. Irregularities in the patterns of rock layers indicate disruptions due to Earth forces (e.g., a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock). |

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| **4.13.4.B Make observations and/or measurements** to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. | | |
| 1 | Identifying the phenomenon under investigation | |
| a | From the given investigation plan, students identify the phenomenon under investigation, which includes the following idea: the effects of weathering or the rate of erosion of Earth’s materials. |
| b | From the given investigation plan, students identify the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon. |
| 2 | Identifying the evidence to address the purpose of the investigation | |
| a | From the given investigation plan, students describe\* the data to be collected that will serve as the basis for evidence. |
| b | From the given investigation plan, students describe\* the evidence needed, based on observations and/or measurements made during the investigation, including: |
| 1. The change in the relative steepness of slope of the area (e.g., no slope, slight slope, steep slope). |
| 1. The kind of weathering or erosion to which the Earth material is exposed. |
| 1. The change in the shape of Earth materials as the result of weathering or the rate of erosion by one of the following: |
| 1. Motion of water. |
| 1. Ice (including melting and freezing processes). |
| 1. Wind (speed and direction). |
| 1. Vegetation. |
| c | Students describe\* how the data to be collected will serve as evidence to address the purpose of the investigation, including to help identify cause and effect relationships between weathering or erosion, and Earth materials. |
| 3 | Planning the investigation | |
| a | From the given investigation plan, students describe\* how the data will be collected, including: |
| 1. The relative speed of the flow of air or water. |
| 1. The number of cycles of freezing and thawing. |
| 1. The number and types of plants growing in the Earth material. |
| 1. The relative amount of soil or sediment transported by erosion. |
| 1. The number or size of rocks transported by erosion. |
| 1. The breakdown of materials by weathering (e.g., ease of breaking before or after weathering, size/number of rocks broken down). |
| b | Students describe\* the controlled variables, including: |
| 1. Those variables that affect the movement of water (e.g., flow speed, volume, slope). |
| 1. Those variables that affect the movement of air. |
| 1. The water temperature and forms of matter (e.g., freezing, melting, room temperature). |
| 1. The presence or absence of plants growing in or on the Earth material. |
| 4 | Collecting the data | |
| a | Students make and record observations according to the given investigation plan to provide evidence for the effects of weathering or the rate of erosion on Earth materials (e.g., rocks, soils, and sediment). |

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| **4.13.4.C Analyze and interpret data** from maps to describe patterns of Earth's features. | | |
| 1 | Organizing data | |
| a | Students organize data using graphical displays (e.g., table, chart, graph) from maps of Earth’s features (e.g., locations of mountains, continental boundaries, volcanoes, earthquakes, deep ocean trenches, ocean floor structures). |
| 2 | Identifying relationships | |
| a | Students identify patterns in the location of Earth features, including the locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes. These relationships include: |
| 1. Volcanoes and earthquakes occur in bands that are often along the boundaries between continents and oceans. |
| 1. Major mountain chains form inside continents or near their edges. |
| 3 | Interpreting data | |
| a | Students use logical reasoning based on the organized data to make sense of and describe\* a phenomenon. In their description\*, students include that Earth features occur in patterns that reflect information about how they are formed or occur (e.g., mountain ranges tend to occur on the edges of continents or inside them, the Pacific Ocean is surrounded by a ring of volcanoes, all continents are surrounded by water [assume Europe and Asia are identified as Eurasia]). |

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| **4.13.4.D Generate and compare multiple solutions** to reduce the impacts of natural Earth processes on humans. | | |
| 1 | Using scientific knowledge to generate design solutions | |
| a | Given a natural Earth process that can have a negative effect on humans (e.g., an earthquake, volcano, flood, landslide), students use scientific information about that Earth process and its effects to design at least two solutions that reduce its effect on humans. |
|  | b | In their design solutions, students describe\* and use cause and effect relationships between the Earth process and its observed effect. |
| 2 | Describing\* criteria and constraints, including quantification when appropriate | |
| a | Students describe\* the given criteria for the design solutions, including using scientific information about the Earth process to describe\* how well the design must alleviate the effect of the Earth process on humans. |
| b | Students describe\* the given constraints of the solution (e.g., cost, materials, time, relevant scientific information), including performance under a range of likely conditions. |
| 3 | Evaluating potential solutions | |
| a | Students evaluate each design solution based on whether and how well it meets the each of the given criteria and constraints. |
| b | Students compare the design solutions to each other based on how well each meets the given criteria and constraints. |
| c | Students describe\* the design solutions in terms of how each alters the effect of the Earth process on humans. |

**FIFTH GRADE**

The fifth grade standards and indicators help students gather, analyze, and communicate evidence as they formulate answers to questions tailored to student interest and current topics that may include but are not limited to:

**When matter changes, does its weight (mass) change?**

Students are able to describe that matter is made of particles too small to be seen through the development of a model. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved.

**Can new substances be created by combining other substances?**

Students determine whether the mixing of two or more substances results in new substance.

**How does matter cycle through ecosystems and where does the energy in food come from and what is it used for?**

Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun.

**How much water can be found in different places on Earth and how does water move through the Earth system?**

Students describe and graph data to provide evidence about the distribution of water on Earth. Through the development of a model using an example students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. This model will also allow students to define a simple design problem that relates to the conservation of fresh water.

**How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?**

Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

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**SC.5.3 Structure and Properties of Matter**

SC.5.3.1 Gather, analyze, and communicate evidence of structure and properties of matter.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.5.3.1.A **Develop a model** to describe that matter is made of particles too small to be seen. 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 does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles. |
|  | **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.5.3.1.B **Measure and graph quantities** to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances. Assessment does not include distinguishing mass and weight. |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.5.3.1.C **Make observations and measurements** to identify materials based on their properties. Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property. Assessment does not include density or distinguishing mass and weight. |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.5.3.1.D **Conduct an investigation** to determine whether the mixing of two or more substances results in new substances. |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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.   * Develop a model to describe phenomena. (5.3.1.A)   **Planning and Carrying Out Investigations**  Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.   * 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. (5.3.1.D) * Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5.3.1.C)   **Using Mathematics and Computational Thinking**  Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.   * Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5.3.1.B) | **Disciplinary Core Ideas**  [**PS1.A**](https://www.nap.edu/read/13165/chapter/9#106)**: Structure and Properties of Matter**   * Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5.3.1.A) * The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5.3.1.B) * Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5.3.1.C)     [**PS1.B**](https://www.nap.edu/read/13165/chapter/9#109)**: Chemical Reactions**   * When two or more different substances are mixed, a new substance with different properties may be formed. (5.3.1.D) * No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5.3.1.B) | **Crosscutting Concepts**  **Cause and Effect**  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.pngCause and effect relationships are routinely identified, tested, and used to explain change. (5.3.1.D)  **Scale, Proportion, and Quantity**  C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.pngNatural objects exist from the very small to the immensely large. (5.3.1.A)  Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5.3.1.B),(5.3.1.C)  **--------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Scientific Knowledge Assumes an Order and Consistency in Natural Systems**   * Science assumes consistent patterns in natural systems. (5.3.1.B) |

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| *Connections to other DCIs in fifth grade:* N/A |
| *Articulation of DCIs across grade-levels:* **2.PS1.A** (5.3.1.A),(5.3.1.B),(5.3.1.C); **2.PS1.B** (5.3.1.B),(5.3.1.D); **MS.PS1.A** (5.3.1.A),(5.3.1.B),(5.3.1.C),(5.3.1.D); **MS.PS1.B** (5.3.1.B),(5.3.1.D) |
| *NGSS Connections:* [Structure and Properties of Matter](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=19) [**5-PS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=99)(5.3.1.A); [**5-PS1-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=102) (5.3.1.B); [**5-PS1-3**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=103) (5.3.1.C); [**5-PS1-4**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=104) (5.3.1.D) |
| *ELA Connections:*  5.1.4.b Demonstrate ethical use of information and copyright guidelines by appropriately quoting or paraphrasing from a text and citing the source using available resources (e.g., online citation tools). (5.3.1.B),(5.3.1.C),( 5.3.1.D)  5.2.1.c Gather and use relevant information and evidence from multiple authoritative print and/or digital sources to support claims or theses. (5.3.1.B),(5.3.1.C),( 5.3.1.D)  5.2.1.i Display academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (5.3.1.B),(5.3.1.C),(5.3.1.D)  5.2.2.c Conduct and publish research projects to answer questions or solve problems using multiple resources to support theses. (5.3.1.B),(5.3.1.C),( 5.3.1.D)  5.4.1.a Locate, organize, analyze, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (5.3.1.A),(5.3.1.B),(5.3.1.C),( 5.3.1.D)  5.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (5.3.1.A) |
| *Mathematics Connections:*  MP.1 Solves mathematical problems. (5.3.1.B),(5.3.1.C)  MP.2 Models and represents math problems. (5.3.1.A),(5.3.1.B),(5.3.1.C)  MP.3 Communicates mathematical ideas effectively. (5.3.1.A),(5.3.1.B),(5.3.1.C)  5.1.1.e Write powers of 10 with exponents. (5.3.1.A)  5.1.2.d Divide a unit fraction by a whole number and a whole number by a unit fraction. (5.3.1.A)  5.1.2.c Multiply a whole number by a fraction or a fraction by a fraction using models and visual representations. (5.3.1.A)  5.3.3.c Generate conversions within the customary and metric systems of measurement. (5.3.1.B)  5.3.3.a Recognize that solid figures have volume that is measured in cubic units. (5.3.1.A)  5.3.3.b Use concrete models to measure the volume of rectangular prisms in cubic units by counting cubic units. (5.3.1.A) |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **5.3.1.A Develop a model** to describe that matter is made of particles too small to be seen. | | |
| 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: |
| 1. Bulk matter (macroscopic observable matter; e.g., as sugar, air, water). |
| 1. 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: |
| 1. Bulk matter and tiny particles that cannot be seen (e.g., tiny particles of matter that cannot be seen make up bulk matter). |
| 1. 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). |

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| **5.3.1.B Measure and graph quantities** to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. | | |
| 1 | Representation | |
| a | Students measure and graph the given quantities using standard units, including: |
| 1. The weight of substances before they are heated, cooled, or mixed. |
| 1. The weight of substances, including any new substances produced by a reaction, after they are heated, cooled, or mixed. |
| 2 | Mathematical/computational analysis | |
| a | Students measure and/or calculate the difference between the total weight of the substances (using standard units) before and after they are heated, cooled, and/or mixed. |
| b | Students describe\* the changes in properties they observe during and/or after heating, cooling, or mixing substances. |
| c | Students use their measurements and calculations to describe\* that the total weights of the substances did not change, regardless of the reaction or changes in properties that were observed. |
| d | Students use measurements and descriptions\* of weight, as well as the assumption of consistent patterns in natural systems, to describe\* evidence to address scientific questions about the conservation of the amount of matter, including the idea that the total weight of matter is conserved after heating, cooling, or mixing substances. |

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| **5.3.1.C Make observations and measurements** to identify materials based on their properties. | | |
| 1 | Identifying the phenomenon under investigation | |
| a | From the given investigation plan, students identify the phenomenon under investigation, which includes the observable and measurable properties of materials. |
| b | Students identify the purpose of the investigation, which includes collecting data to serve as the basis for evidence for an explanation about the idea that materials can be identified based on their observable and measurable properties. |
| 2 | Identifying the evidence to address the purpose of the investigation | |
| a | From the given investigation plan, students describe\* the evidence from data (e.g., qualitative observations and measurements) that will be collected, including: |
| 1. Properties of materials that can be used to identify those materials (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility). |
| b | Students describe\* how the observations and measurements will provide the data necessary to address the purpose of the investigation. |
| 3 | Planning the investigation | |
| a | From the given plan investigation plan, students describe\* how the data will be collected. Examples could include: |
| 1. Quantitative measures of properties, in standard units (e.g., grams, liters). |
| 1. Observations of properties such as color, conductivity, and reflectivity. |
| 1. Determination of conductors vs. nonconductors and magnetic vs. nonmagnetic materials. |
| b | Students describe\* how the observations and measurements they make will allow them to identify materials based on their properties. |
| 4 | Collecting the data | |
| a | Students collect and record data, according to the given investigation plan. |

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| **5.3.1.D Conduct an investigation** to determine whether the mixing of two or more substances results in new substances. | | |
| 1 | Identifying the phenomenon under investigation | |
| a | From the given investigation plan, students describe\* the phenomenon under investigation, which includes the mixing of two or more substances. |
| b | Students identify the purpose of the investigation, which includes providing evidence for whether new substances are formed by mixing two or more substances, based on the properties of the resulting substance. |
| 2 | Identifying the evidence to address the purpose of the investigation | |
| a | From the given investigation plan, students describe\* the evidence from data that will be collected, including: |
| 1. Quantitative (e.g., weight) and qualitative properties (e.g., state of matter, color, texture, odor) of the substances to be mixed. |
| 1. Quantitative and qualitative properties of the resulting substances. |
| b | Students describe\* how the collected data can serve as evidence for whether the mixing of the two or more tested substances results in one or more new substances. |
| 3 | Planning the investigation | |
| a | From the given investigation plan, students describe\* how the data will be collected, including: |
| 1. How quantitative and qualitative properties of the two or more substances to be mixed will be determined and measured. |
| 1. How quantitative and qualitative properties of the substances that resulted from the mixture of the two or more substances will be determined and measured. |
| 1. Number of trials for the investigation. |
| 1. How variables will be controlled to ensure a fair test (e.g., the temperature at which the substances are mixed, the number of substances mixed together in each trial). |
| 4 | Collecting the data | |
| a | According to the investigation plan, students collaboratively collect and record data, including data about the substances before and after mixing. |

**SC.5.8 Matter and Energy in Organisms and Ecosystems**

SC.5.8.2 Gather and analyze data to communicate understanding of matter and energy in organisms and ecosystems.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png | SC.5.8.2.A **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. Examples of models could include diagrams, and flow charts. | |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png | SC.5.8.2.B **Support an argument** that plants get the materials they need for growth chiefly from air and water. Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil. | |
|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png | SC.5.8.2.C **Develop a model** to describe the movement of matter among plants, animals, decomposers, and the environment. 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 does not include molecular explanations or the biochemical mechanisms of photosynthesis. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE ecosystems* |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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. (5.8.2.A) * Develop a model to describe phenomena. (5.8.2.C)   **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. (5.8.2.B)   **---------------------------------------------------**  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena**   * Science explanations describe the mechanisms for natural events. (5.8.2.C) | **Disciplinary Core Ideas**  [**PS3.D**](https://www.nap.edu/read/13165/chapter/9?term=ps3.d#128)**: Energy in Chemical Processes and Everyday Life**   * The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5.8.2.A)   [**LS1.C**](https://www.nap.edu/read/13165/chapter/10#147)**: Organization for Matter and Energy Flow in Organisms**   * Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. *(secondary to 5.8.2.A)* * Plants acquire their material for growth chiefly from air and water. (5.8.2.B)   [**LS2.A**](https://www.nap.edu/read/13165/chapter/10#150)**: Interdependent Relationships in Ecosystems**  The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5.8.2.C)  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**LS2.B**](https://www.nap.edu/read/13165/chapter/10?term=ls2.b#152)**: Cycles of Matter and Energy Transfer in Ecosystems**  Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5.8.2.C) | **Crosscutting Concepts**  **Systems and System Models**  C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.pngA system can be described in terms of its components and their interactions. (5.8.2.C)  **Energy and Matter**  C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.pngMatter is transported into, out of, and within systems. (5.8.2.B)   * Energy can be transferred in various ways and between objects. (5.8.2.A) |

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| *Connections to other DCIs in fifth grade:*  **5.PS1.A** (5.8.2.B),(5.8.2.C); **5.ESS2.A** (5.8.2.C) |
| *Articulation of DCIs across grade-levels:* **K.LS1.C** (5.8.2.A),(5.8.2.B); **2.PS1.A** (5.8.2.C); **2.LS2.A** (5.8.2.A),(5.8.2.B); **2.LS4.D** (5.8.2.C); **4.PS3.A** (5.8.2.A); **4.PS3.B** (5.8.2.A); **4.PS3.D** (5.8.2.A); **4.ESS2.E** (5.8.2.C);**MS.PS3.D** (5.8.2.A),(5.8.2.C); **MS.PS4.B** (5.8.2.A); **MS.LS1.C** (5.8.2.A),(5.8.2.B),(5.8.2.C); **MS.LS2.A** (5.8.2.C); **MS.LS2.B** (5.8.2.A),(5.8.2.C) |
| *NGSS Connections:* [Matter and Energy in Organisms and Ecosystems](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=20)  [**5-PS3-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=111) (5.8.2.A); [**5-LS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=112) (5.8.2.B); [**5-LS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=113)(5.8.2.C) |
| *ELA Connections:*  5.1.6.iConstruct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources. (5.8.2.B)  5.1.6.k Select text for a particular purpose (e.g., answer a question, solve problems, enjoy, form an opinion, understand a specific viewpoint, predict outcomes, discover models for own writing, accomplish a task), citing evidence to support analysis, reflection, or research. (5.8.2.B)  5.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (5.8.2.B)  5.1.6.n Make and confirm/modify predictions and inferences with text evidence while previewing and reading literary, informational, digital text, and/or media. (5.8.2.B)  5.1.6.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (5.8.2.B)  5.2.2.a Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats. (5.8.2.B)  5.2.1.a Generate a draft that develops a clear topic suited to the purpose and intended audience and organizational pattern, including a strong thesis, body, conclusion, and appropriate transitions linked to the purpose of the composition. (5.8.2.B)  5.3.1.cUtilize appropriate visual and/or digital tools to enhance verbal communication and add interest. (5.8.2.A),(5.8.2.C)  5.4.1.a Locate, organize, analyze, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (5.8.2.A),(5.8.2.C)  5.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (5.8.2.A),(5.8.2.C*)* |
| Mathematics Connections:  MP.1 Solves mathematical problems. (5.8.2.B)  MP.2 Models and represents math problems. (5.8.2.B),(5.8.2.C)  MP.3 Communicates mathematical ideas effectively. (5.8.2.B),(5.8.2.C)  5.3.3.c Generate conversions within the customary and metric systems of measurement. (5.8.2.B) |
| *Connections:* |
| *Connections:* |

**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **5.8.2.A 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. | | |
| 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: |
| 1. Energy. |
| 1. The sun. |
| 1. Animals, including their bodily functions (e.g., body repair, growth, motion, body warmth maintenance). |
| 1. Plants. |
| 2 | Relationships | |
| a | Students identify and describe\* the relevant relationships between components, including: |
| 1. The relationship between plants and the energy they get from sunlight to produce food. |
| 1. The relationship between food and the energy and materials that animals require for bodily functions (e.g., body repair, growth, motion, body warmth maintenance). |
| 1. 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: |
| 1. 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. |
| 1. Energy from the sun is transferred to animals through a chain of events that begins with plants producing food then being eaten by animals. |

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| **5.8.2.B Support an argument** that plants get the materials they need for growth chiefly from air and water. | | |
| 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: |
| 1. Plant growth over time. |
| 1. 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). |
| 1. Plants’ inability to grow without water. |
| 1. Plants’ inability to grow without air. |
| 1. 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: |
| 1. Whether a particular material (e.g., air, soil) is required for growth of plants. |
| 1. 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: |
| 1. 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. |
| 1. 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. |
| 1. Therefore, plants do not acquire most of the material for growth from soil. |
| 1. 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. |
| 1. 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. |

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| **5.8.2.C Develop a model** to describe the movement of matter among plants, animals, decomposers, and the environment. | | |
| 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: |
| 1. Matter. |
| 1. Plants. |
| 1. Animals. |
| 1. Decomposers, such as fungi and bacteria. |
| 1. Environment. |
| 2 | Relationships | |
| a | Students describe\* the relationships among components that are relevant for describing\* the phenomenon, including: |
| 1. The relationships in the system between organisms that consume other organisms, including: |
| 1. Animals that consume other animals. |
| 1. Animals that consume plants. |
| 1. Organisms that consume dead plants and animals. |
| 1. The movement of matter between organisms during consumption. |
| 1. 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\*: |
| 1. The cycling of matter in the system between plants, animals, decomposers, and the environment. |
| 1. How interactions in the system of plants, animals, decomposers, and the environment allow multiple species to meet their needs. |
| 1. 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). |
| 1. That changing an aspect (e.g., organisms or environment) of the ecosystem will affect other aspects of the ecosystem. |

**SC.5.11 Space Systems: Earth’s Stars and Solar System**

SC.5.11.3 Gather and analyze data to communicate understanding of space systems: Earth’s stars and solar system.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png | SC.5.11.3.A **Support an argument** that the gravitational force exerted by Earth on objects is directed down. “Down” is a local description of the direction that points toward the center of the spherical Earth. Assessment does not include mathematical representation of gravitational force. |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.5.11.3.B **Support an argument** that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, and stage). |
| **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png | SC.5.11.3.C **Represent data in graphical displays** to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. 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 does not include causes of seasons. |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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. (5.11.3.C)   **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. (5.11.3.A),(5.11.3.B) | **Disciplinary Core Ideas**  [**PS2.B**](https://www.nap.edu/read/13165/chapter/9#116)**: Types of Interactions**   * The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center. (5.11.3.A)   [**ESS1.A**](https://www.nap.edu/read/13165/chapter/11#173)**: The Universe and its Stars**   * The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5.11.3.B)   [**ESS1.B**](https://www.nap.edu/read/13165/chapter/11#175)**: 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. (5.11.3.C) | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png**Patterns**  Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5.11.3.C)  C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect**  Cause and effect relationships are routinely identified and used to explain change. (5.11.3.A)  C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png**Scale, Proportion, and Quantity**  Natural objects exist from the very small to the immensely large. (5.11.3.B) |

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| *Connections to other DCIs in fifth grade:* N/A |
| *Articulation of DCIs across grade-levels:* **1.ESS1.A** (5.11.3.C); **1.ESS1.B** (5.11.3.C); **3.PS2.A** (5.11.3.A),(5.11.3.C); **3.PS2.B** (5.11.3.A); **MS.PS2.B** (5.11.3.A)**; MS.ESS1.A** (5.11.3.B),(5.11.3.C)**; MS.ESS1.B** (5.11.3.A),(5.11.3.B),(5.11.3.C); **MS.ESS2.C** (5.11.3.A) |
| *NGSS Connections:* [Space Systems: Stars and the Solar System](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=22) [**5-PS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=110) (5.11.3.A); [**5-ESS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=114) (5.11.3.B); [**5-ESS1-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=115)(5.11.3.C) |
| *ELA Connections:*  5.1.6.iConstruct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources. (5.11.3.A),(5.11.3.B)  5.1.6.n Make and confirm/modify predictions and inferences with text evidence while previewing and reading literary, informational, digital text, and/or media. (5.11.3.A),(5.11.3.B)  5.1.6.i Construct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources.  (5.11.3.B)  5.1.6.k Select text for a particular purpose (e.g., answer a question, solve problems, enjoy, form an opinion, understand a specific   viewpoint, predict outcomes, discover models for own writing, accomplish a task), citing evidence to support analysis, reflection, or   research. (5.11.3.B)  5.1.6.k Select text for a particular purpose (e.g., answer a question, solve problems, enjoy, form an opinion, understand a specific viewpoint, predict outcomes, discover models for own writing, accomplish a task), citing evidence to support analysis, reflection, or research. (5.11.3.A),(5.11.3.B)  5.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (5.11.3.A),(5.11.3.B)  5.1.6.o Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media). (5.11.3.A),(5.11.3.B)  5.2.2.a Communicate information and ideas effectively in analytic, descriptive, informative, narrative, poetic, persuasive, and reflective modes to multiple audiences using a variety of media and formats. (5.11.3.A),(5.11.3.B)  5.2.1.a Generate a draft that develops a clear topic suited to the purpose and intended audience and organizational pattern, including a strong thesis, body, conclusion, and appropriate transitions linked to the purpose of the composition. (5.11.3.A),(5.11.3.B)  5.3.1.cUtilize appropriate visual and/or digital tools to enhance verbal communication and add interest. (5.11.3.C)  5.4.1.a Locate, organize, analyze, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (5.11.3.B)  5.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (5.11.3.C) |
| *Mathematics Connections:*  MP.2 Models and represents math problems. (5.11.3.B),(5.11.3.C)  MP.3 Communicates mathematical ideas effectively. (5.11.3.B),(5.11.3.C)  MA 5.1.1.e Write powers of 10 with exponents. (5.11.3.B)  MA 5.3.2.a Identify the origin, x axis, and y axis of the coordinate plane. (5.11.3.C)  MA 5.3.2.b Graph and name points in the first quadrant of the coordinate plane using ordered pairs of whole numbers. (5.11.3.C) |
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| **5.11.3.A Support an argument** that the gravitational force exerted by Earth on objects is directed down. | | |
| 1 | Supported claims | |
| a | Students identify a given claim to be supported about a phenomenon. The claim includes the idea that the gravitational force exerted by Earth on objects is directed down toward the center of Earth. |
| 2 | Identifying scientific evidence | |
| a | Students identify and describe\* the given evidence, data, and/or models that support the claim, including: |
| 1. Multiple lines of evidence that indicate that the Earth’s shape is spherical (e.g., observation of ships sailing beyond the horizon, the shape of the Earth’s shadow on the moon during an eclipse, the changing height of the North Star above the horizon as people travel north and south). |
| 1. That objects dropped appear to fall straight down. |
| 1. That people live all around the spherical Earth, and they all observe that objects appear to fall straight down. |
| 3 | Evaluation and critique | |
| a | Students evaluate the evidence to determine whether it is sufficient and relevant to supporting the claim. |
| b | Students describe\* whether any additional evidence is needed to support the claim. |
| 4 | Reasoning and synthesis | |
| a | Students use reasoning to connect the relevant and appropriate evidence to support the claim with argumentation. Students describe\* a chain of reasoning that includes: |
| 1. If Earth is spherical, and all observers see objects near them falling directly “down” to the Earth’s surface, then all observers would agree that objects fall toward the Earth’s center. |
| 1. Since an object that is initially stationary when held moves downward when it is released, there must be a force (gravity) acting on the object that pulls the object toward the center of Earth. |

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| **5.11.3.B Support an argument** that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. | | |
| 1 | Supported claims | |
| a | Students identify a given claim to be supported about a given phenomenon. The claim includes the idea thatthe apparent brightness of the sun and stars is due to their relative distances from Earth. |
| 2 | Identifying scientific evidence | |
| a | Students describe\* the evidence, data, and/or models that support the claim, including: |
| 1. The sun and other stars are natural bodies in the sky that give off their own light. |
| 1. The apparent brightness of a variety of stars, including the sun. |
| 1. A luminous object close to a person appears much brighter and larger than a similar object that is very far away from a person (e.g., nearby streetlights appear bigger and brighter than distant streetlights). |
| 1. The relative distance of the sun and stars from Earth (e.g., although the sun and other stars are all far from the Earth, the stars are very much farther away; the sun is much closer to Earth than other stars). |
| 3 | Evaluating and critiquing evidence | |
| a | Students evaluate the evidence to determine whether it is relevant to supporting the claim, and sufficient to describe\* the relationship between apparent size and apparent brightness of the sun and other stars and their relative distances from Earth. |
| b | Students determine whether additional evidence is needed to support the claim. |
| 4 | Reasoning and synthesis | |
| a | Students use reasoning to connect the relevant and appropriate evidence to the claim with argumentation. Students describe\* a chain of reasoning that includes: |
| 1. Because stars are defined as natural bodies that give off their own light, the sun is a star. |
| 1. The sun is many times larger than Earth but appears small because it is very far away. |
| 1. Even though the sun is very far from Earth, it is much closer than other stars. |
| 1. Because the sun is closer to Earth than any other star, it appears much larger and brighter than any other star in the sky. |
| 1. Because objects appear smaller and dimmer the farther they are from the viewer, other stars, although immensely large compared to the Earth, seem much smaller and dimmer because they are so far away. |
| 1. Although stars are immensely large compared to Earth, they appear small and dim because they are so far away. |
| 1. Similar stars vary in apparent brightness, indicating that they vary in distance from Earth. |

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| **5.11.3.C Represent data in graphical displays** to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal   appearance of some stars in the night sky. | | |
| 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: |
| 1. The length and direction of shadows observed several times during one day. |
| 1. The duration of daylight throughout the year, as determined by sunrise and sunset times. |
| 1. 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: |
| 1. 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. |
| 1. 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. |
| 1. 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: |
| 1. 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). |

**SC.5.13 Earth’s Systems**SC.5.13.4 Gather and analyze data to communicate understanding of Earth’s systems.

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|  |  | C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png | SC.5.13.4.A **Develop a model** using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system. Assessment is limited to the interactions of two systems at a time. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE systems* |
| **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.5.13.4.B **Describe and graph** the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. Assessment is limited to oceans, lakes, rivers, glaciers, groundwater, and polar ice caps but does not include the atmosphere. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE bodies of water* |
| **C:\Users\sara.cooper.NDE\Desktop\Standards\ComputerScienceConnection.png** | C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png | SC.5.13.4.C **Obtain and combine information** about ways individual communities use science ideas to protect the Earth’s resources and environment. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE conservation organizations* |
| C:\Users\sara.cooper.NDE\Desktop\Standards\CivicConnection.png | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png | C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png | SC.5.13.4.D **Define a simple design problem** that can be solved by applying scientific ideas about the conservation of fresh water on Earth. | |
| C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png | *NE conservation organizations* |
|  | C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png |  | SC.5.13.4.E **Define a simple design problem** reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. | |

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| The example indicators above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: | | | NOTES |
| **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.   * Develop a model using an example to describe a scientific principle. (5.13.4.A)   **Using Mathematics and Computational Thinking**  Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.   * Describe and graph quantities such as area and volume to address scientific questions. (5.13.4.B)   **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. (5.13.4.C)   **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. (5.13.4.D),(5.13.4.E) | **Disciplinary Core Ideas**  [**ESS2.A**](https://www.nap.edu/read/13165/chapter/11?term=ess2.a#179)**: Earth Materials and Systems**  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5.13.4.A)  [**ESS2.C**](https://www.nap.edu/read/13165/chapter/11#184)**: The Roles of Water in Earth’s Surface Processes**  Nearly all of Earth’s available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5.13.4.B)  C:\Users\sara.cooper.NDE\Desktop\Standards\NebraskaConnection.png[**ESS3.C**](https://www.nap.edu/read/13165/chapter/11#194)**: Human Impacts on Earth Systems**  Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments. (5.13.4.C), (5.13.4.D)  [**ETS1.A**](https://www.nap.edu/read/13165/chapter/12#204)**: Defining and Delimiting Engineering Problems**  C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.pngPossible 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. (5.13.4.E) | **Crosscutting Concepts**  C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png**Scale, Proportion, and Quantity**  Standard units are used to measure and describe physical quantities such as weight, and volume. (5.13.4.B)  C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png**Systems and System Models**  A system can be described in terms of its components and their interactions. (5.13.4.A),(5.13.4.C),(5.13.4.D)  **------------------------------------------**  C:\Users\sara.cooper.NDE\Desktop\Standards\EngineeringConnection'.png[***Connections to Engineering, Technology,******and Applications of Science***](http://nstahosted.org/pdfs/ngss/20130509/AppendixJ-ScienceTechnologySocietyAndTheEnvironment_0.pdf)  **Influence of Science, Engineering, and Technology on Society and the Natural World**   * Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (5.13.4.D) * People’s needs and wants change over time, as do their demands for new and improved technologies. (5.13.4.E)   ***--------------------------------------------------------***  [***Connections to Nature of Science***](http://nstahosted.org/pdfs/ngss/AppendixH-TheNatureOfScienceInTheNextGenerationScienceStandards-4.9.13.pdf)  **Science Addresses Questions About the Natural and Material World**   * Science findings are limited to questions that can be answered with empirical evidence. (5.13.4.C)   **Science is a Human Endeavor**   * Science affects everyday life. (5.13.4.D) |

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| *Connections to other DCIs in fifth grade:* N/A |
| *Articulation of DCIs across grade-levels:* **2.ESS2.A** (5.13.4.A); **2.ESS2.C** (5.13.4.B); **3.ESS2.D** (5.13.4.A); **4.ESS2.A** (5.13.4.A); **MS.ESS2.A** (5.13.4.A); **MS.ESS2.C** (5.13.4.A),(5.13.4.B); **MS.ESS2.D** (5.13.4.A); **MS.ESS3.A** (5.13.4.B),(5.13.4.C); **MS.ESS3.C** (5.13.4.C); **MS.ESS3.D** (5.13.4.C); **ETS1.A** |
| *NGSS Connections:* [Earth’s Systems](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=21) [**5-ESS2-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=119) (5.13.4.A); [**5-ESS2-2**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=121)(5.13.4.B); [**5-ESS3-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=123) (5.13.4.C) [Engineering Design](http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=23) [**3-5-ETS1-1**](http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=126) (5.13.4.E) |
| *ELA Connections:*  5.1.4.b Demonstrate ethical use of information and copyright guidelines by appropriately quoting or paraphrasing from a text and citing the source using available resources (e.g., online citation tools). (5.13.4.B),(5.13.4.C)  5.1.6.iConstruct and/or answer literal, inferential, and critical questions and support answers with explicit evidence from the text or additional sources. (5.13.4.C)  5.1.6.k Select text for a particular purpose (e.g., answer a question, solve problems, enjoy, form an opinion, understand a specific viewpoint, predict outcomes, discover models for own writing, accomplish a task), citing evidence to support analysis, reflection, or research. (5.13.4.C)  5.1.6.l Build background knowledge and activate prior knowledge to identify text-to-self, text-to-text, and text-to-world connections before, during, and after reading. (5.13.4.C)  5.1.6.n Make and confirm/modify predictions and inferences with text evidence while previewing and reading literary, informational, digital text, and/or media. (5.13.4.C)  5.2.1.c Gather and use relevant information and evidence from multiple authoritative print and/or digital sources to support claims or theses. (5.13.4.C)  5.2.1.i Display academic honesty and integrity by avoiding plagiarism and/or overreliance on any one source and by following a standard format for citation. (5.13.4.B),(5.13.4.C)  5.2.2.c Conduct and publish research projects to answer questions or solve problems using multiple resources to support theses. (5.13.4.B),(5.13.4.C)  5.3.1.cUtilize appropriate visual and/or digital tools to enhance verbal communication and add interest. (5.13.4.A),(5.13.4.B)  5.4.1.a Locate, organize, analyze, and evaluate information from print and digital resources to generate and answer questions and create new understandings. (5.13.4.A),(5.13.4.B),(5.13.4.C)  5.4.1.c Use or decipher multiple formats of print and digital text (e.g., cursive, manuscript, font, graphics, symbols). (5.13.4.A),(5.13.4.B),(5.13.4.C) |
| *Mathematics Connections:*  MP.2 Models and represents math problems. (5.13.4.A),(5.13.4.B),(5.13.4.C)  MP.3 Communicates mathematical ideas effectively. (5.13.4.A),(5.13.4.B),(5.13.4.C)  5.3.2.a Identify the origin, x axis, and y axis of the coordinate plane. (5.13.4.A)  5.3.2.b Graph and name points in the first quadrant of the coordinate plane using ordered pairs of whole numbers. (5.13.4.A) |
| *Connections:* |
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**Evidence Statements: Observable features of the student performance by the end of the grade.**

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| **5.13.4.A Develop a model** using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. | | |
| 1 | Components of the model | |
| a | Students develop a model, using a specific given example of a phenomenon, to describe\* ways that the geosphere, biosphere, hydrosphere, and/or atmosphere interact. In their model, students identify the relevant components of their example, including features of two of the following systems that are relevant for the given example: |
| 1. Geosphere (i.e., solid and molten rock, soil, sediment, continents, mountains). |
| 1. Hydrosphere (i.e., water and ice in the form of rivers, lakes, glaciers). |
| 1. Atmosphere (i.e., wind, oxygen). |
| 1. Biosphere (i.e., plants, animals [including humans]). |
| 2 | Relationships | |
| a | Students identify and describe\* relationships (interactions) within and between the parts of the Earth systems identified in the model that are relevant to the example (e.g., the atmosphere and the hydrosphere interact by exchanging water through evaporation and precipitation; the hydrosphere and atmosphere interact through air temperature changes, which lead to the formation or melting of ice). |
| 3 | Connections | |
| a | Students use the model to describe\* a variety of ways in which the parts of two major Earth systems in the specific given example interact to affect the Earth’s surface materials and processes in that context. Students use the model to describe\* how parts of an individual Earth system: |
| 1. Work together to affect the functioning of that Earth system. |
| 1. Contribute to the functioning of the other relevant Earth system. |

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| **5.13.4.B Describe and graph** the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. | | |
| 1 | Representation | |
| a | Students graph the given data (using standard units) about the amount of salt water and the amount of fresh water in each of the following reservoirs, as well as in all the reservoirs combined, to address a scientific question: |
| 1. Oceans. |
| 1. Lakes. |
| 1. Rivers. |
| 1. Glaciers. |
| 1. Ground water. |
| 1. Polar ice caps. |
| 2 | Mathematical/computational analysis | |
| a | Students use the graphs of the relative amounts of total salt water and total fresh water in each of the reservoirs to describe\* that: |
| 1. The majority of water on Earth is found in the oceans. |
| 1. Most of the Earth’s fresh water is stored in glaciers or underground. |
| 1. A small fraction of fresh water is found in lakes, rivers, wetlands, and the atmosphere. |

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| **5.13.4.C Obtain and combine information** about ways individual communities use science ideas to protect the Earth’s resources and environment. | | |
| 1 | Obtaining information | |
| a | Students obtain information from books and other reliable media about: |
| * 1. How a given human activity (e.g., in agriculture, industry, everyday life) affects the Earth’s resources and environments. |
| * 1. 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: |
| 1. The positive and negative effects on the environment as a result of human activities. |
| 1. 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. |

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| **5.13.4.D Define a simple design problem** that can be solved by applying scientific ideas about the conservation of fresh water on Earth. | | |
| 1 | Identifying the problem to be solved | |
| a | Students use given scientific information about water resources to define a simple design problem that includes water conservation. |
| 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 water conservation issues on Earth. |
| 3 | Defining the criteria and constraints | |
| a | Students specify criteria (required features) of a successful solution for water conservation. |
| b | Students describe\* the constraints or limitations on their design, which may include: |
| 1. Cost. |
| 1. Materials. |
| 1. Time. |

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| **5.13.4.E Define a simple design problem** reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. | | |
| 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: |
| 1. Cost. |
| 1. Materials. |
| 1. Time. |

**3-5 Disciplinary Core Idea Elements**

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| ***PS1 Matter and Its Interactions***  **PS1.A Structure and Properties of Matter**   * Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5.3.1.A) * The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5.3.1.B) * Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5.3.1.C)   **PS1.B Chemical Reactions**   * When two or more different substances are mixed, a new substance with different properties may be formed. (5.3.1.D) * No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5.3.1.B) | ***PS2 Motion and Stability: Forces and Interactions***  **PS2.A Forces and Motion**   * Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object’s speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3.1.1.A) * The patterns of an object’s motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3.1.1.B)   **PS2.B Types of Interactions**   * Objects in contact exert forces on each other. (3.1.1.A) * Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3.1.1.C),(3.1.1.D) * The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center. (5.11.3.A) | ***PS3 Energy***  **PS3.A Definitions of Energy**   * The faster a given object is moving, the more energy it possesses. (4.4.2.A) * Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4.4.2.B), (4.4.2.C)   **PS3.B Conservation of Energy and Energy Transfer**   * Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4.4.2.B), (4.4.2.C) * Light also transfers energy from place to place. (4.4.2.B) * Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4.4.2.B), (4.4.2.D)   **PS3.C Relationship Between Energy and Forces**   * When objects collide, the contact forces transfer energy so as to change the objects’ motions. (4.4.2.C)   **PS3.D Energy in Chemical Processes and Everyday Life**   * Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4.4.2.D) * 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). (5.8.2.A) |
| ***PS4 Waves and Their Applications in Technologies for Information Transfer***  **PS4.A Wave Properties**   * Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (4.2.1.A) * Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4.2.1.A)   **PS4.B Electromagnetic Radiation**   * An object can be seen when light reflected from its surface enters the eyes. (4.6.3.A)   **PS4.C Information Technologies and Instrumentation**   * Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4.2.1.B) |

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| ***LS1 From Molecules to Organisms: Structures and Processes***  **LS1.A Structure and Function**   * Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4.6.3.B)   **LS1.B Growth and Development of Organisms**   * Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3.9.3.A)   **LS1.C Organization for Matter and Energy Flow in Organisms**   * Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5.8.2.A) * Plants acquire their material for growth chiefly from air and water. (5.8.2.B)   **LS1.D Information Processing**   * Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal’s brain. Animals are able to use their perceptions and memories to guide their actions. (4.6.3.C) | ***LS2 Ecosystems: Interactions, Energy, and Dynamics***  **LS2.A Interdependent Relationships in Ecosystems**   * The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5.8.2.C)   **LS2.B Cycles of Matter and Energy Transfer in Ecosystems**   * Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5.8.2.C)   **LS2.C Ecosystem Dynamics, Functioning, and Resilience**   * When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. *(secondary to 3.7.2.D)*   **LS2.D Social Interactions and Group Behavior**   * Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (3.7.2.A) | ***LS3 Heredity: Inheritance and Variation of Traits***  **LS3.A: Inheritance of Traits**   * Many characteristics of organisms are inherited from their parents. (3.9.3.B) * Other characteristics result from individuals’ interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3.9.3.C)   **LS3.B: Variation of Traits**   * Different organisms vary in how they look and function because they have different inherited information. (3.9.3.B) * The environment also affects the traits that an organism develops. (3.9.3.C) |
| ***Biological Evolution: Unity & Diversity***  **LS4.A: Evidence of Common Ancestry and Diversity**   * Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (3.7.2.B) * Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3.7.2.B)   **LS4.B: Natural Selection**   * Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3.9.3.D)   **LS4.C: Adaptation**   * For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3.7.2.C)   **LS4.D: Biodiversity and Humans**   * Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3.7.2.D) |

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| ***ESS1 Earth’s Place in the Universe***  **ESS1.A The Universe and Its Stars**   * The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5.11.3.B)   **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. (5.11.3.C)   **ESS1.C The History of Planet Earth**   * Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4.13.4.A) | ***ESS2 Earth’s Systems***  **ESS2.A Earth Materials and Systems**   * Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4.13.4.B) * Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5.13.4.A)   **ESS2.B Plate Tectonics and Large-Scale System Interactions**   * The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4.13.4.C)   **ESS2.C The Roles of Water in Earth’s Surface Processes**   * Nearly all of Earth’s available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5.13.4.B)   **ESS2.D Weather and Climate**   * Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3.12.4.A) * Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3.12.4.B) * **ESS2.E Biogeology**   Living things affect the physical characteristics of their regions. (4.13.4.B) | ***ESS3 Earth and Human Activity***  **ESS3.A Natural Resources**   * Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4.4.2.F)   **ESS3.B: Natural Hazards**   * A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3.12.4.C) *(Note: This Disciplinary Core Idea is also addressed by 4.13.4.D.)*   **ESS3.C Human Impacts on Earth Systems**   * Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments. (5.13.4.C), (5.13.4.D) |
| ***ETS1 Engineering Design***  **ETS1.A Defining and Delimiting Engineering Problems**   * Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (5.13.4.E)   **ETS1.B Developing Possible Solutions**   * Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3.7.2.E) * At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3.7.2.E) * Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (4.4.2.E) * Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4.13.4.D)   **ETS1.C Optimizing the Design Solution**   * Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (secondary to 4.2.1.B) * Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (4.4.2.E) | | |

**3-5 Crosscutting Concept Elements**

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| C:\Users\sara.cooper.NDE\Desktop\Standards\Patterns.png**Patterns** – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. |
| * Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. * Patterns of change can be used to make predictions. * Patterns can be used as evidence to support an explanation. |
| C:\Users\sara.cooper.NDE\Desktop\Standards\CauseEffect.png**Cause and Effect: Mechanism and Prediction** – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. |
| * Cause and effect relationships are routinely identified, tested, and used to explain change. * Events that occur together with regularity might or might not be a cause and effect relationship. |
| C:\Users\sara.cooper.NDE\Desktop\Standards\ScaleProportionQuantity.png**Scale, Proportion, and Quantity** – In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. |
| * Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods. * Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. |
| C:\Users\sara.cooper.NDE\Desktop\Standards\Systems.png**Systems and System Models –** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. |
| * 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. |
| C:\Users\sara.cooper.NDE\Desktop\Standards\EnergyMatter.png**Energy and Matter: Flows, Cycles, and Conservation** – Tracking energy and matter flows, into, out of, and within systems helps one understand their system’s behavior. |
| * Matter is made of particles. * Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems. * Energy can be transferred in various ways and between objects. |
| C:\Users\sara.cooper.NDE\Desktop\Standards\StructureFunction.png**Structure and Function** – The way an object is shaped or structured determines many of its properties and functions. |
| * Different materials have different substructures, which can sometimes be observed. * Substructures have shapes and parts that serve functions. |
| C:\Users\sara.cooper.NDE\Desktop\Standards\StabilityChange.png**Stability and Change** – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. |
| * Change is measured in terms of differences over time and may occur at different rates. * Some systems appear stable, but over long periods of time will eventually change. |

\* Adapted from: National Research Council (2011). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academy Press. Chapter 4: Crosscutting Concepts.

**3-5 Science and Engineering Practice Elements**

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| **Asking questions and defining problems** in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.   * Ask questions about what would happen if a variable is changed. * Identify scientific (testable) and non-scientific (non-testable) questions. * Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. * Use prior knowledge to describe problems that can be solved. * 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 | **Mathematical and computational thinking** in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.   * Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. * Organize simple datasets to reveal patterns that suggest relationships. * Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems. * Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem. |
| **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.   * Identify limitations of models. * Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events. * Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. * Develop and/or use models to describe and/or predict phenomena. * Develop a diagram or simple physical prototype to convey a proposed object, tool, or process. * Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. | **Constructing explanations and designing solutions** in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.   * Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard). * Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. * Identify the evidence that supports particular points in an explanation. * Apply scientific ideas to solve design problems. * Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. |
| **Planning and carrying out investigations** to answer questions or test solutions to problems in 3–5 builds on K–2 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. * Evaluate appropriate methods and/or tools for collecting data. * Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. * Make predictions about what would happen if a variable changes. * Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success. | **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).   * Compare and refine arguments based on an evaluation of the evidence presented. * Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. * Respectfully provide and receive critiques from peers about a proposed procedure,  explanation, or model by citing relevant evidence and posing specific questions. * Construct and/or support an argument with evidence, data, and/or a model. * Use data to evaluate claims about cause and effect. * Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. |
| **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 tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. * Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. * Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. * Analyze data to refine a problem statement or the design of a proposed object, tool, or process. * Use data to evaluate and refine design solutions | **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.   * 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. * Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices. * Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices. * Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. * Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts. |

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| **Topic\Grade** | **K** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **HS** |
| **1** Forces & Interactions | **SC.K.1** |  |  | **SC.3.1** |  |  |  |  | **SC.8.1** | **SC.HS.1** |
| **2** Waves & Electro-magnetic Radiation |  | **SC.1.2** |  |  | **SC.4.2** |  |  |  | **SC.8.2** | **SC.HS.2** |
| **3** Structure & Properties of Matter |  |  | **SC.2.3** |  |  | **SC.5.3** |  | **SC.7.3** |  | **SC.HS.3** |
| **4** Energy |  |  |  |  | **SC.4.4** |  | **SC.6.4** |  | **SC.8.4** | **SC.HS.4** |
| **5** Chemical Reactions |  |  |  |  |  |  |  | **SC.7.5** |  | **SC.HS.5** |
| **6** Structure & Function |  | **SC.1.6** |  |  | **SC.4.6** |  | **SC.6.6** |  |  | **SC.HS.6** |
| **7** Inter-dependent Relationships in Ecosystems | **SC.K.7** |  | **SC.2.7** | **SC.3.7** |  |  |  | **SC.7.7** |  | **SC.HS.7** |
| **8** Matter & Energy in Organisms & Ecosystems |  |  |  |  |  | **SC.5.8** |  | **SC.7.8** |  | **SC.HS.8** |
| **9** Heredity: Inheritance & Variation of Traits |  |  |  | **SC.3.9** |  |  | **SC.6.9** |  | **SC.8.9** | **SC.HS.9** |
| **10** Biological Evolution |  |  |  |  |  |  |  |  | **SC.8.10** | **SC.HS.10** |
| **11** Space Systems |  | **SC.1.11** |  |  |  | **SC.5.11** |  |  | **SC.8.11** | **SC.HS.11** |
| **12** Weather & Climate | **SC.K.12** |  |  | **SC.3.12** |  |  | **SC.6.12** |  |  | **SC.HS.12** |
| **13** Earth’s Systems |  |  | **SC.2.13** |  | **SC.4.13** | **SC.5.13** | **SC.6.13** | **SC.7.13** |  | **SC.HS.13** |
| **14** History of Earth |  |  |  |  |  |  |  | **SC.7.14** | **SC.8.14** | **SC.HS.14** |
| **15** Sustainability |  |  |  |  |  |  |  |  |  | **SC.HS.15** |