GRADE 5

Grade 5 students have developed many skills that enable them to conduct more refined measurements of data and communicate scientific information with greater detail through various forms of presentation. They are able to recognize the process needed for planning and carrying out investigations, relate numeric relationships to patterns discovered in data, and identify the role of design solutions to problems occurring in real life. Many fifth graders are emerging scientific thinkers. An encouraging and challenging learning environment can inspire fifth graders to develop a passion for science and engineering.

Fifth-grade students learn disciplinary core ideas from the three scientific domains of Physical, Life, and Earth and Space Sciences while demonstrating their learning in the context of the content standards for this grade level. In Physical Science, students classify matter based on its physical and chemical properties and carry out investigations to provide evidence of the principle of conservation of matter. In Life Science, they develop models to explain the flow of energy and matter in ecosystems, including classifying resources into living and nonliving and classifying organisms into producers, consumers, and decomposers. In Earth and Space Science, students use multiple ways to illustrate the distribution of water on Earth and the interaction of the atmosphere, biosphere, geosphere, and hydrosphere. Students obtain information about ways individuals and communities can protect Earth's resources and environment. Fifth graders find evidence of the gravitational force that pulls all objects downward, evaluate factors that cause some stars to shine more brightly than others, and construct explanations for the patterns of seasons, day and night, and the seasonal changes of stars visible in the sky. The disciplinary core ideas of the Engineering, Technology, and Applications of Science (ETS) domain are integrated within the content standards of the three scientific domains and are denoted with an asterisk (*).

Grade 5 content standards provide students with opportunities for investigation, observation, and explanation of a variety of scientific phenomena. Through participation in specific engineering design projects, students find answers regarding which methods can be used to clean a polluted environment and how to modify the speed of a falling object due to gravity.

Grade 5: Structure and Properties of Matter

(Matter and Its Interactions)

Students will:

AL.5.1 - Plan and carry out investigations (e.g., adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, evaporating salt water) to provide evidence that matter is made of particles too small to be seen.

AL.5.2 - Investigate matter to provide mathematical evidence, including graphs, to show that regardless of the type of reaction (e.g., new substance forming due to dissolving or mixing) or change (e.g., phase change) that occurs when heating, cooling, or mixing substances, the total weight of the matter is conserved.

AL.5.3 - Examine matter through observations and measurements to identify materials (e.g., powders, metals, minerals, liquids) based on their properties (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, solubility, density).

AL.5.4 - Investigate whether the mixing of two or more substances results in new substances (e.g., mixing of baking soda and vinegar resulting in the formation of a new substance, gas; mixing of sand and water resulting in no new substance being formed).

AL.5.5 - Construct explanations from observations to determine how the density of an object affects whether the object sinks or floats when placed in a liquid.*

Grade 5: Structure and Properties of Matter

(Matter and Its Interactions)

Students who demonstrate understanding can:

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

5-PS1-2 **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.** [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.]

5-PS1-3 **Make observations and measurements to identify materials based on their properties.** [Clarification Statement: 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.]

5-PS1-4 **Conduct an investigation to determine whether the mixing of two or more substances results in new substances.**

Grade 5: Structure and Properties of Matter

(Matter and Its Interactions)

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

Science and Engineering Practices

Developing and Using Models

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

- Use models to describe phenomena. (5-PS1-1)

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-PS1-4)
- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)

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-PS1-2)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

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

PS1.B: Chemical Reactions

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

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (5-PS1-4)

Scale, Proportion, and Quantity

- Natural objects exist from the very small to the immensely large. (5-PS1-1)
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2),(5-PS1-3)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (5-PS1-2)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels:
2.PS1.A (5-PS1-1),(5-PS1-2),(5-PS1-3); **2.PS1.B** 5-PS1-2),(5-PS1-4); **MS.PS1.A** (5-PS1-1),(5-PS1-2),(5-PS1-3),(5-PS1-4); **MS.PS1.B** 5-PS1-2),(5-PS1-4)

Common Core State Standards Connections:
ELA/Literacy -

RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.(5-PS1-1)
W.5.7	Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2),(5-PS1-3),(5-PS1-4)
W.5.8	Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2),(5-PS1-3),(5-PS1-4)
W.5.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2),(5-PS1-3),(5-PS1-4)

Grade 5: Structure and Properties of Matter

(Matter and Its Interactions)

Mathematics -	
MP.2	Reason abstractly and quantitatively. (5-PS1-1),(5-PS1-2),(5-PS1-3)
MP.4	Model with mathematics. (5-PS1-1),(5-PS1-2),(5-PS1-3)
MP.5	Use appropriate tools strategically. (PS1-2),(PS1-3)
5.NBT.A.1	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1)
5.NF.B.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1)
5.MD.A.1	Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. (5-PS1-2)
5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)
5.MD.C.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-1)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 5: Matter and Energy in Organisms and Ecosystems

(Ecosystems: Interactions, Energy and Dynamics)

Students will:

AL.5.8 - Defend the position that plants obtain materials needed for growth primarily from air and water.

AL.5.9 - Construct an illustration to explain how plants use light energy to convert carbon dioxide and water into a storable fuel, carbohydrates, and a waste product, oxygen, during the process of photosynthesis.

AL.5.10 - Construct and interpret models (e.g., diagrams, flow charts) to explain that energy in animals' food is used for body repair, growth, motion, and maintenance of body warmth and was once energy from the sun.

AL.5.11 - Create a model to illustrate the transfer of matter among producers; consumers, including scavengers and decomposers; and the environment.

Students who demonstrate understanding can:

5-PS3-1 **Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.** [Clarification Statement: Examples of models could include diagrams, and flow charts.]

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

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

Grade 5: Matter and Energy in Organisms and Ecosystems

(Ecosystems: Interactions, Energy and Dynamics)

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

Science and Engineering Practices

Developing and Using Models

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

- Use models to describe phenomena. (5-PS3-1)
- Develop a model to describe phenomena. (5-LS2-1)

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-LS1-1)

Connections to the Nature of Science

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

- Science explanations describe the mechanisms for natural events. (5-LS2-1)

Disciplinary Core Ideas

PS3.D: Energy in Chemical Processes and Everyday Life

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

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

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

LS2.A: Interdependent Relationships in Ecosystems

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

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

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

Crosscutting Concepts

Systems and System Models

- A system can be described in terms of its components and their interactions. (5-LS2-1)

Energy and Matter

- Matter is transported into, out of, and within systems. (5-LS1-1)
- Energy can be transferred in various ways and between objects. (5-PS3-1)

Grade 5: Matter and Energy in Organisms and Ecosystems

(Ecosystems: Interactions, Energy and Dynamics)

Connections to other DCIs in fifth grade:
5.PS1.A (5-LS1-1),(5-LS2-1); **5.ESS2.A** (5-LS2-1)

Articulation of DCIs across grade-levels:
K.LS1.C (5-PS3-1),(5- LS1-1); **2.PS1.A** (5-LS2-1); **2.LS2.A** (5-PS3-1),(5-LS1-1); **2.LS4.D** (5-LS2-1); **4.PS3.A** (5-PS3-1); **4.PS3.B** (5-PS3-1); **4.PS3.D** (5-PS3-1); **4.ESS2.E**(5-LS2-1); **MS.PS3.D** (5-PS3-1),(5-LS2-1); **MS.PS4.B** (5-PS3-1); **MS.LS1.C** (5- PS3-1),(5-LS1-1),(5-LS2-1); **MS.LS2.A** (5-LS2-1); **MS.LS2.B** (5-PS3-1),(5-LS2-1)

Common Core State Standards Connections:

ELA/Literacy -

RI.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)
RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1),(5-LS2-1)
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)
W.5.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)
SL.5.5	Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1),(5-LS2-1)

Mathematics -

MP.2	Reason abstractly and quantitatively. (5-LS1-1),(5-LS2-1)
MP.4	Model with mathematics. (5-LS1-1),(5-LS2-1)
MP.5	Use appropriate tools strategically. (5-LS1-1)
5.MD.A.1	Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1-1)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 5: Earth's Systems

(Earth's Systems)

(Earth and Human Activity)

Students will:

AL.5.14 - Use a model to represent how any two systems, specifically the atmosphere, biosphere, geosphere, and/or hydrosphere, interact and support life (e.g., influence of the ocean on ecosystems, landform shape, and climate; influence of the atmosphere on landforms and ecosystems through weather and climate; influence of mountain ranges on winds and clouds in the atmosphere).

AL.5.15 - Identify the distribution of freshwater and salt water on Earth (e.g., oceans, lakes, rivers, glaciers, ground water, polar ice caps) and construct a graphical representation depicting the amounts and percentages found in different reservoirs.

AL.5.16 - Collect and organize scientific ideas that individuals and communities can use to protect Earth's natural resources and its environment (e.g., terracing land to prevent soil erosion, utilizing no-till farming to improve soil fertility, regulating emissions from factories and automobiles to reduce air pollution, recycling to reduce overuse of landfill areas).

AL.5.17 - Design solutions, test, and revise a process for cleaning a polluted environment (e.g., simulating an oil spill in the ocean or a flood in a city and creating a solution for containment and/or cleanup).*

Students who demonstrate understanding can:

5-ESS2-1 **Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.** [Clarification Statement: 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 Boundary: Assessment is limited to the interactions of two systems at a time.*]

5-ESS2-2 **Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.** [*Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.*]

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

Grade 5: Earth's Systems

(Earth's Systems)

(Earth and Human Activity)

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

Science and Engineering Practices

Developing and Using Models

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

- Develop a model using an example to describe a scientific principle. (5-ESS2-1)

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-ESS2-2)

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-ESS3-1)

Disciplinary Core Ideas

ESS2.A: Earth Materials and Systems

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

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

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

ESS3.C: Human Impacts on Earth Systems

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

Crosscutting Concepts

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight and volume. (5-ESS2-2)

Systems and System Models

- A system can be described in terms of its components and their interactions. (5-ESS2-1),(5-ESS3-1)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World.

- Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels:
2.ESS2.A (5-ESS2-1); **2.ESS2.C** (5-ESS2-2); **3.ESS2.D** (5-ESS2-1); **4.ESS2.A** (5-ESS2-1); **MS.ESS2.A** (5-ESS2-1); **MS.ESS2.C** (5-ESS2-1),(5-ESS2-2); **MS.ESS2.D** (5-ESS2-1); **MS.ESS3.A** (5-ESS2-2),(5-ESS3-1); **MS.ESS3.C** (5-ESS3-1); **MS.ESS3.D** (5-ESS3-1)

Common Core State Standards Connections:

ELA/Literacy -

RI.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)
RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)
W.5.8	Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2),(5-ESS3-1)
W.5.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)
SL.5.5	Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1),(5-ESS2-2)

Mathematics -

MP.2	Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
MP.4	Model with mathematics. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
5.G.A.2	Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 5: Space Systems: Stars and the Solar System

(Motion and Stability: Forces and Interactions)

(Earth's Place in the Universe)

Students will:

AL.5.6 - Construct an explanation from evidence to illustrate that the gravitational force exerted by Earth on objects is directed downward towards the center of Earth.

AL.5.7 - Design and conduct a test to modify the speed of a falling object due to gravity (e.g., constructing a parachute to keep an attached object from breaking).*

AL.5.12 - Defend the claim that one factor determining the apparent brightness of the sun compared to other stars is the relative distance from Earth.

AL.5.13 - Analyze data and represent with graphs to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky (e.g., shadows and the position and motion of Earth with respect to the sun, visibility of select stars only in particular months).

Students who demonstrate understanding can:

5-PS2-1 **Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [*Assessment Boundary: Assessment does not include mathematical representation of gravitational force.*]

5-ESS1-1 **Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.** [*Assessment Boundary: 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, stage).*]

5-ESS1-2 **Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [*Assessment Boundary: Assessment does not include causes of seasons.*]

Grade 5: Space Systems: Stars and the Solar System

(Motion and Stability: Forces and Interactions)

(Earth's Place in the Universe)

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

Science and Engineering Practices

Analyzing and Interpreting Data

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

- Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2)

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-PS2-1),(5-ESS1-1)

Disciplinary Core Ideas

PS2.B: Types of Interactions

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

ESS1.A: The Universe and its Stars

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

ESS1.B: Earth and the Solar System

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

Crosscutting Concepts

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)

Scale, Proportion, and Quantity

- Natural objects exist from the very small to the immensely large. (5-ESS1-1)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels:

1.ESS1.A (5-ESS1-2); **1.ESS1.B** (5-ESS1-2); **3.PS2.A** (5-PS2-1),(5-ESS1-2); **3.PS2.B** (5-PS2-1); **MS.PS2.B** (5-PS2-1); **MS.ESS1.A** (5-ESS1-1),(5-ESS1-2); **MS.ESS1.B** (5-PS2-1),(5-ESS1-1),(5-ESS1-2); **MS.ESS2.C** (5-PS2-1)

Common Core State Standards Connections:

ELA/Literacy -

RI.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1),(5-ESS1-1)
RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.(5-ESS1-1)
RI.5.8	Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1)
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1),(5-ESS1-1)
W.5.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1),(5-ESS1-1)
SL.5.5	Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)

Mathematics -

MP.2	Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2)
MP.4	Model with mathematics. (5-ESS1-1),(5-ESS1-2)
5.NBT.A.2	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-ESS1-1)
5.G.A.2	Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 5 - Engineering Design

Engineering, technology, and science core disciplinary ideas are integrated into grade level science performance expectations.

Students will:

AL.5.5 - Construct explanations from observations to determine how the density of an object affects whether the object sinks or floats when placed in a liquid. *

AL.5.7 - Design and conduct a test to modify the speed of a falling object due to gravity (e.g., constructing a parachute to keep an attached object from breaking).*

AL.5.17 -Design solutions, test, and revise a process for cleaning a polluted environment (e.g., simulating an oil spill in the ocean or a flood in a city and creating a solution for containment and/or cleanup).*

Students who demonstrate understanding can:

3-5-ETS1-1	**Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
3-5-ETS1-2	**Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
3-5-ETS1-3	**Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Grade 5: Engineering Design

Engineering, technology, and science core disciplinary ideas are integrated into grade level science performance expectations.

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

Science and Engineering Practices

Asking Questions and Defining Problems

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

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

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. (3-5-ETS1-3)

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. (3-5-ETS1-2)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

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

ETS1.B: Developing Possible Solutions

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

ETS1.C: Optimizing the Design Solution

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

Crosscutting Concepts

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

- People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Connections to 3-5-ETS1.A: Defining and Delimiting Engineering Problems include:

Fourth Grade: 4-PS3-4

Connections to 3-5-ETS1.B: Developing Possible Solutions Problems include:

Fourth Grade: 4-ESS3-2

Connections to K-2-ETS1.C: Optimizing the Design Solution include:

Fourth Grade: 4-PS4-3

Articulation of DCIs across grade-levels:

K-2.ETS1.A (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); **K-2.ETS1.B** (3-5-ETS1-2); **K-2.ETS1.C** (3-5-ETS1-2),(3-5-ETS1-3); MS.ETS1.A (3-5-ETS1-1); **MS.ETS1.B** (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); **MS.ETS1.C** (3-5-ETS1-2),(3-5-ETS1-3)

Common Core State Standards Connections:

ELA/Literacy -

RI.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS1-2)
RI.5.1	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)
W.5.7	Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)
W.5.8	Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)
W.5.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)

Grade 5: Engineering Design

Engineering, technology, and science core disciplinary ideas are integrated into grade level science performance expectations.

Mathematics -	
3.OA	Operations and Algebraic Thinking (3-ETS1-1),(3-ETS1-2)
MP.2	Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
MP.4	Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
MP.5	Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
3-5.OA	Operations and Algebraic Thinking (3-ETS1-1),(3-ETS1-2)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.