Topic Arrangements of the Next Generation Science Standards

At the beginning of the NGSS development process, in order to eliminate potential redundancy, seek an appropriate grain size, and seek natural connections among the Disciplinary Core Ideas (DCIs) identified within the Framework for K-12 Science Education, the writers arranged the DCIs into topics around which to develop the standards. This structure provided the original basis of the standards, and is preferred by many states. However, the coding structure of individual performance expectations reflects the DCI arrangement in the Framework.

Due to the fact that the NGSS progress toward end-of-high school core ideas, the standards may be rearranged in any order within a grade level.

Table of Contents

Elementary Introduction .................................................................................................................. 3
Kindergarten Storyline .................................................................................................................. 4
K.Foices and Interactions: Pushes and Pulls .............................................................................. 5
K.Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment ....... 6
K.Weather and Climate .................................................................................................................. 7
First Grade Storyline ................................................................................................................... 8
1.Waves: Light and Sound ............................................................................................................ 9
1.Structure, Function, and Information Processing ................................................................. 10
1.Space Systems: Patterns and Cycles ..................................................................................... 11
Second Grade Storyline .............................................................................................................. 12
2.Structure and Properties of Matter ....................................................................................... 13
2.Interdependent Relationships in Ecosystems ......................................................................... 14
2.Earth’s Systems: Processes that Shape the Earth ................................................................. 15
K-2.Engineering Design .............................................................................................................. 16
Third Grade Storyline ............................................................................................................... 17
3.Foices and Interactions ........................................................................................................... 18
3.Interdependent Relationships in Ecosystems ....................................................................... 19
3.Inheritance and Variation of Traits: Life Cycles and Traits .............................................. 20
3.Weather and Climate .............................................................................................................. 21
Fourth Grade Storyline .............................................................................................................. 22
4.Energy ................................................................................................................................... 23
4.Waves: Waves and Information ............................................................................................ 24
4.Structure, Function, and Information Processing ................................................................. 25
4.Earth’s Systems: Processes that Shape the Earth ................................................................. 26
Fifth Grade Storyline .................................................................................................................. 27
5.Structure and Properties of Matter ....................................................................................... 28
5.Matter and Energy in Organisms and Ecosystems ............................................................... 29
5.Earth's Systems ...................................................................................................................... 30
3-5.Engineering Design ............................................................................................................ 32
Middle School Physical Sciences Storyline .............................................................................. 33
Middle School Life Sciences Storyline .................................................................................... 34
Middle School Earth and Space Sciences Storyline ............................................................... 36
Middle School Engineering Design Storyline .......................................................................... 39
MS.Structure and Properties of Matter ..................................................................................... 40
MS.Chemical Reactions ............................................................................................................. 42
MS.Foices and Interactions ......................................................................................................... 43
MS.Energy ................................................................................................................................. 45
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS.Waves and Electromagnetic Radiation</td>
<td>47</td>
</tr>
<tr>
<td>MS.Structure, Function, and Information Processing</td>
<td>48</td>
</tr>
<tr>
<td>MS.Matter and Energy in Organisms and Ecosystems</td>
<td>50</td>
</tr>
<tr>
<td>MS.Interdependent Relationships in Ecosystems</td>
<td>52</td>
</tr>
<tr>
<td>MS.Growth, Development, and Reproduction of Organisms</td>
<td>53</td>
</tr>
<tr>
<td>MS.Natural Selection and Adaptations</td>
<td>55</td>
</tr>
<tr>
<td>MS.Space Systems</td>
<td>57</td>
</tr>
<tr>
<td>MS.History of Earth</td>
<td>58</td>
</tr>
<tr>
<td>MS.Earth’s Systems</td>
<td>59</td>
</tr>
<tr>
<td>MS.Weather and Climate</td>
<td>60</td>
</tr>
<tr>
<td>MS.Human Impacts</td>
<td>61</td>
</tr>
<tr>
<td>MS.Engineering Design</td>
<td>63</td>
</tr>
<tr>
<td>High School Physical Sciences Storyline</td>
<td>65</td>
</tr>
<tr>
<td>High School Life Sciences Storyline</td>
<td>68</td>
</tr>
<tr>
<td>High School Earth and Space Sciences Storyline</td>
<td>70</td>
</tr>
<tr>
<td>High School Engineering Design Storyline</td>
<td>73</td>
</tr>
<tr>
<td>HS.Structure and Properties of Matter</td>
<td>74</td>
</tr>
<tr>
<td>HS.Chemical Reactions</td>
<td>76</td>
</tr>
<tr>
<td>HS.Forces and Interactions</td>
<td>78</td>
</tr>
<tr>
<td>HS.Energy</td>
<td>80</td>
</tr>
<tr>
<td>HS.Waves and Electromagnetic Radiation</td>
<td>82</td>
</tr>
<tr>
<td>HS.Structure and Function</td>
<td>84</td>
</tr>
<tr>
<td>HS.Matter and Energy in Organisms and Ecosystems</td>
<td>85</td>
</tr>
<tr>
<td>HS.Interdependent Relationships in Ecosystems</td>
<td>87</td>
</tr>
<tr>
<td>HS.Inheritance and Variation of Traits</td>
<td>89</td>
</tr>
<tr>
<td>HS.Natural Selection and Evolution</td>
<td>91</td>
</tr>
<tr>
<td>HS.Space Systems</td>
<td>93</td>
</tr>
<tr>
<td>HS.History of Earth</td>
<td>95</td>
</tr>
<tr>
<td>HS.Earth’s Systems</td>
<td>97</td>
</tr>
<tr>
<td>HS.Weather and Climate</td>
<td>99</td>
</tr>
<tr>
<td>HS.Human Sustainability</td>
<td>100</td>
</tr>
<tr>
<td>HS.Engineering Design</td>
<td>102</td>
</tr>
</tbody>
</table>
Elementary Standards

Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s). The performance expectations in elementary school grade bands develop ideas and skills that will allow students to explain more complex phenomena in the four disciplines as they progress to middle school and high school. While the performance expectations shown in kindergarten through fifth grade couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many practices that lead to the performance expectations.
Fifth Grade

The performance expectations in fifth grade help students formulate answers to questions such as: “When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? 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?”

Fifth grade performance expectations include PS1, PS2, PS3, LS1, LS2, ESS1, ESS2, and ESS3 Disciplinary Core Ideas from the NRC Framework. 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. Students determine whether the mixing of two or more substances results in new substances. Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the distribution of water on Earth. 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. 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. The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; energy and matter; and systems and systems models are called out as organizing concepts for these disciplinary core ideas. In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.
## 5. Structure and Properties of Matter

### 5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.

Students who demonstrate understanding can:
- Develop a model 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)

### 5-PS1-2. Measure and graph quantities such as weight.

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 mathematics and computer technologies 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: Matter 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 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, tested, 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)

### 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)

## Science and Engineering Practices

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing and Using Models</td>
<td>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.</td>
</tr>
</tbody>
</table>

### Disciplinary Core Ideas

#### PS1.A: Matter 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 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, tested, 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)

### 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)
5. Matter and Energy in Organisms and Ecosystems

**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)

**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)

**Connections to Nature of Science**

**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena**
- Science explanations describe the mechanisms for natural events. (5-LS2-1)

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.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.1.5** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)
- **RI.1.7** 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.1.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)
- **W.1.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)
- **SL.1.5** 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.*
5.Earth’s Systems

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.

The performance expectations above 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 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)

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

The section entitled "Disciplinary Core Ideas" is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.

June 2013 ©2013 Achieve, Inc. All rights reserved.
5.Space Systems: Stars and the Solar System

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 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.]

The performance expectations above were developed using the following elements from the NRC documents: A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated Articulation of DCIs across grade levels:

Science and Engineering Practices

- Analyzing and Interpreting Data
- Engaging in Argument from Evidence

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:


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-ESS1-1)

Mathematics –

MP.2 Reason abstractly and quantitatively. (5-ESS1-1), (5-ESS1-2)

MP.4 Model with mathematics. (5-ESS1-1), (5-ESS1-2)

S.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)

S.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)
## 3-5. Engineering Design

Students who demonstrate understanding can:

### 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

### 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.

---

### Science and Engineering Practices

<table>
<thead>
<tr>
<th>Asking Questions and Defining Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking questions and defining problems in 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships.</td>
</tr>
<tr>
<td>• 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)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planning and Carrying Out Investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>• 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)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constructing Explanations and Designing Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>• 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)</td>
</tr>
</tbody>
</table>

---

### Disciplinary Core Ideas

<table>
<thead>
<tr>
<th>ETS1A: Defining and Delimiting Engineering Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 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)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ETS1B: Developing Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 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)</td>
</tr>
<tr>
<td>• 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)</td>
</tr>
<tr>
<td>• 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)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ETS1C: Optimizing the Design Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 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)</td>
</tr>
</tbody>
</table>

---

### 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-ETS1A: Defining and Delimiting Engineering Problems include:

- Fourth Grade: 4-PS3-4
- Connections to 3-5-ETS1B: Designing Solutions to Engineering Problems include:
  - Fourth Grade: 4-ESS3-2
- Connections to 3-5-ETS1C: Optimizing the Design Solution include:
  - Fourth Grade: 4-PS3-3

### Articulation of DCIs across grade-bands:

- **K-2.ETS1A** (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); **K-2.ETS1B** (3-5-ETS1-2); **K-2.ETS1C** (3-5-ETS1-2),(3-5-ETS1-3); **MS.ETS1A** (3-5-ETS1-1); **MS.ETS1B** (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); **MS.ETS1C** (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-ETS2) |
| 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. (3-5-ETS2) |
| RI.5.9 | Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS2) |
| 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 | Evaluate the credibility of information or sources given in 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) |

#### Mathematics –

| 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 (3-5-ETS1-1),(3-5-ETS1-2) |