Next Generation Science Standards Science

# Grade 5

Adopted 2013

**Matter and Its Interactions** 5-PS1

**Students who demonstrate understanding can:**

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

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. 5-PS1-2

5-PS1-3. Make observations and measurements to identify materials based on their properties. 5-PS1-3

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

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**Motion and Stability: Forces and Interactions** 5-PS2

**Students who demonstrate understanding can:**

5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down. 5-PS2-1

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**Energy** 5-PS3

**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. 5-PS3-1

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

**Students who demonstrate understanding can:**

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. 5-LS1-1

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

**Students who demonstrate understanding can:**

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. 5-LS2-1

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

**Students who demonstrate understanding can:**

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. 5-ESS1-1

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. 5-ESS1-2

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**Earth's Systems** 5-ESS2

**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. 5-ESS2-1

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. 5-ESS2-2

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**Earth and Human Activity** 5-ESS3

**Students who demonstrate understanding can:**

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

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**Engineering Design** 3-5-ETS1

**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-ETS1-1

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-ETS1-2

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. 3-5-ETS1-3

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**Science and Engineering Practices** SEP

1. **Analyzing and Interpreting Data** SEP.1

   3-5. 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. SEP.1.3-5

   - Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. SEP.1.3-5.3

## 2. Asking Questions and Defining Problems SEP.2

3-5. Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. SEP.2.3-5

- 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. SEP.2.3-5.4

## 3. Constructing Explanations and Designing Solutions SEP.3

3-5. 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. SEP.3.3-5

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. SEP.3.3-5.5
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. SEP.3.3-5.7

## 4. Developing and Using Models SEP.4

3-5. 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. SEP.4.3-5

- Develop a model to describe phenomena. SEP.4.3-5.4
- Use models to describe phenomena. SEP.4.3-5.5
- Develop a model using an example to describe a scientific principle. SEP.4.3-5.6

## 5. Engaging in Argument from Evidence SEP.5

3-5. 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). SEP.5.3-5

- Support an argument with evidence, data, or a model. SEP.5.3-5.4

## 6. Obtaining, Evaluating, and Communicating Information SEP.6

3-5. 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. SEP.6.3-5

- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. SEP.6.3-5.2

**7. Planning and Carrying Out Investigations** SEP.7

3-5. 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. SEP.7.3-5

- 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. SEP.7.3-5.1
- 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. SEP.7.3-5.5
- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. SEP.7.3-5.6

**11. Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** SEP.11

- Science explanations describe the mechanisms for natural events. SEP.11.2

**12. Using Mathematics and Computational Thinking** SEP.12

5. 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. SEP.12.5

- Measure and graph quantities such as weight to address scientific and engineering questions and problems. SEP.12.5.1
- Describe and graph quantities such as area and volume to address scientific questions. SEP.12.5.2

## Disciplinary Core Ideas DCI

**A. Structure and Properties of Matter** DCI.PS1.A

- 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. DCI.PS1.A.3-5.1
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. DCI.PS1.A.3-5.2
- 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.) DCI.PS1.A.3-5.3

### B. Chemical Reactions DCI.PS1.B

- When two or more different substances are mixed, a new substance with different properties may be formed. DCI.PS1.B.3-5.1
- 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.) DCI.PS1.B.3-5.2

### B. Types of Interactions DCI.PS2.B

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. DCI.PS2.B.3-5.3

### D. Energy in Chemical Processes and Everyday Life DCI.PS3.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). DCI.PS3.D.3-5.2

### C. Organization for Matter and Energy Flow in Organisms DCI.LS1.C

- 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. DCI.LS1.C.3-5.2
- Plants acquire their material for growth chiefly from air and water. DCI.LS1.C.3-5.3

### A. Interdependent Relationships in Ecosystems DCI.LS2.A

- 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. DCI.LS2.A.3-5.3

### B. Cycles of Matter and Energy Transfer in Ecosystems DCI.LS2.B

- 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. DCI.LS2.B.3-5.1

### A. The Universe and its Stars DCI.ESS1.A

- 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. DCI.ESS1.A.3-5.2

### B. Earth and the Solar System DCI.ESS1.B

- 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. DCI.ESS1.B.3-5.2

### A. Earth Materials and Systems DCI.ESS2.A

- 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. DCI.ESS2.A.3-5.3

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

- 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. DCI.ESS2.C.3-5.2

### C. Human Impacts on Earth Systems DCI.ESS3.C

- 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. DCI.ESS3.C.3-5.2

### A. Defining and Delimiting Engineering Problems DCI.ETS1.A

- 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. DCI.ETS1.A.3-5.1

### B. Developing Possible Solutions DCI.ETS1.B

- 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. DCI.ETS1.B.3-5.2
- 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. DCI.ETS1.B.3-5.3
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. DCI.ETS1.B.3-5.4

### C. Optimizing the Design Solution DCI.ETS1.C

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. DCI.ETS1.C.3-5.2

## Crosscutting Concepts CCC

### 1. Patterns CCC.1

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. CCC.1.3-5.9

### 2. Cause and Effect CCC.2

- Cause and effect relationships are routinely identified, tested, and used to explain change. CCC.2.3-5.4
- Cause and effect relationships are routinely identified and used to explain change. CCC.2.3-5.5

### 3. Scale, Proportion, and Quantity CCC.3

- Natural objects exist from the very small to the immensely large. CCC.3.3-5.2
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. CCC.3.3-5.3
- Standard units are used to measure and describe physical quantities such as weight and volume. CCC.3.3-5.4

### 4. Systems and System Models CCC.4

- A system can be described in terms of its components and their interactions. CCC.4.3-5.2

### 5. Energy and Matter CCC.5

- Energy can be transferred in various ways and between objects. CCC.5.3-5.2
- Matter is transported into, out of, and within systems. CCC.5.3-5.3

### 8. Influence of Engineering, Technology, and Science on Society and the Natural World CCC.8

- People's needs and wants change over time, as do their demands for new and improved technologies. CCC.8.3-5.5
- Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. CCC.8.3-5.8

### 10. Science Addresses Questions About the Natural and Material World CCC.10

- Science findings are limited to questions that can be answered with empirical evidence. CCC.10.3-5.2

### 11. Scientific Knowledge Assumes an Order and Consistency in Natural Systems CCC.11

- Science assumes consistent patterns in natural systems. CCC.11.3-5.3