

Grade 2 Science, Unit 3

Changes to Matter

Overview

Unit abstract

In this unit of study, students continue to develop an understanding of observable properties of materials through analysis and classification of different materials. The crosscutting concepts of cause and effect and energy and matter are called out as organizing concepts for these disciplinary core ideas. In the second grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in constructing explanations, designing solutions, and engaging in argument from evidence. Students are expected to use these practices to demonstrate understanding of the core ideas.

Essential questions

- How are materials similar to and different from one another?
- How do the properties of the materials relate to their use?

Written Curriculum

Next Generation Science Standards

2. Structure and Properties of Matter		
Students who demonstrate understanding can: 2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]		
The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
Science and Engineering Practices Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. <ul style="list-style-type: none"> ▪ Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3) 	Disciplinary Core Ideas PS1.A: Structure and Properties of Matter <ul style="list-style-type: none"> ▪ Different properties are suited to different purposes. (2-PS1-3) ▪ A great variety of objects can be built up from a small set of pieces. (2-PS1-3) 	Crosscutting Concepts Energy and Matter <ul style="list-style-type: none"> ▪ Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3)
<i>Connections to other DCIs in second grade:</i> N/A		
<i>Articulation of DCIs across grade-levels:</i> 4.ESS2.A (2-PS1-3); 5.PS1.A (2-PS1-3); 5.LS2.A (2-PS1-3)		
<i>Common Core State Standards Connections:</i> <i>ELA/Literacy –</i> W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-3) W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-3)		

2. Structure and Properties of Matter		
Students who demonstrate understanding can: 2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]		
The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
<p style="text-align: center;">Science and Engineering Practices</p> <p>Engaging in Argument from Evidence Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). ▪ Construct an argument with evidence to support a claim. (2-PS1-4)</p> <hr style="border-top: 1px dashed black;"/> <p style="text-align: center;">Connections to Nature of Science</p> <p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena ▪ Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)</p>	<p style="text-align: center;">Disciplinary Core Ideas</p> <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> ▪ Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4) 	<p style="text-align: center;">Crosscutting Concepts</p> <p>Cause and Effect</p> <ul style="list-style-type: none"> ▪ Events have causes that generate observable patterns. (2-PS1-4)
Connections to other DCIs in second grade: N/A		
Articulation of DCIs across grade-levels: 5.PS1.B (2-PS1-4)		
Common Core State Standards Connections: ELA/Literacy –		
<p>RI.2.1 Ask and answer such questions as <i>who, what, where, when, why,</i> and <i>how</i> to demonstrate understanding of key details in a text. (2-PS1-4)</p> <p>RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)</p> <p>RI.2.8 Describe how reasons support specific points the author makes in a text. (2-PS1-4)</p> <p>W.2.1 Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., <i>because, and, also</i>) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4)</p>		

Clarifying the standards

Prior learning

There are no disciplinary core ideas that are considered prior learning for the concepts in this unit of study.

Progression of current learning

Driving question 1

In what ways can an object made of a small set of pieces be disassembled and made into a new object?

Concepts

- Objects may break into smaller pieces and be put together into larger pieces or change shapes.
- Different properties are suited to different purposes.
- A great variety of objects can be built up from a small set of pieces.

Practices

- Break objects into smaller pieces and put them together into larger pieces or change shapes.
- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

Driving question 2

Can all changes caused by heating or cooling be reversed?

Concepts

- Scientists search for cause-and-effect relationships to explain natural events.
- Events have causes that generate observable patterns.
- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

Practices

- Observe patterns in events generated due to cause-and-effect relationships.
- Construct an argument with evidence to support a claim.
- Construct an argument with evidence that some changes caused by heating or cooling can be reversed, and some cannot.
 - Examples of reversible changes could include materials such as water and butter at different temperatures.
 - Examples of irreversible changes could include
 - Cooking an egg
 - Freezing a plant leaf
 - Heating paper

Integration of content, practices, and crosscutting concepts

In this unit of study, students investigate cause-and-effect relationships between matter and energy as they analyze and classify materials that undergo change. Throughout the unit, students will construct explanations and engage in argument from evidence as they investigate the ways in which matter can change and determine whether or not a change is reversible.

In Unit 2, Properties of Matter, students engaged in the engineering design process in order to understand that different properties are suited to different purposes. Students use this understanding as they construct evidence-based accounts of how an object made of small pieces can be disassembled and made into new objects. In order to do this, they need multiple opportunities to take apart and reassemble objects that are made of small pieces. For example, using blocks, building bricks, and other small objects such as Legos, small groups of students can build an object, and then a second group of students can take the object apart and build another object using those same small blocks or bricks. As students construct and deconstruct objects, then reconstruct the pieces into new objects, they should document the process in their science journals, explaining how they went about reconstructing the pieces into a new object.

After students have worked through and documented this process, ask them, “Are the changes you made to each of the original objects reversible? Can we disassemble the new objects and use the pieces to reconstruct the original object? After class discussion, ask students, “Are all changes reversible?” This should lead to opportunities for students to observe changes caused by heating or cooling. With close supervision and guidance by teachers, students can investigate such changes as heating or cooling butter, chocolate chips, or pieces of crayon, freezing water, and melting ice. They can observe an egg before and after cooking or a small piece of paper or cardboard before and after burning. As they attempt to reverse changes, they will also notice that all events have causes that generate patterns of change that can be observed and predicted. Through these types of experiences, students will recognize that some changes caused by heating or cooling can be reversed and some cannot, and they can use evidence from their investigations to support their thinking.

Integration of DCI from other units within this grade level

In Unit 2, Properties of Matter, students described and classified different kinds of materials based on their observable properties. They also tested different materials to determine which have properties that are best suited for an intended purpose.

Integration of English language arts/literacy and mathematics

The CCSS for English language arts can be incorporated into this unit in a variety of ways. Teachers will need to provide opportunities for students to read texts that give information about matter and the changes that can happen to matter. With adult support, students can identify the main idea and details in informational text in order to answer questions about matter. With teacher support and modeling, students can ask and answer *who*, *what*, *where*, *when*, *why*, and *how* questions to demonstrate their understanding of key details in informational text.

As students investigate reversible and irreversible changes to matter, they should record observations in science journals, using drawings or other visual displays, when appropriate, to help clarify their thinking. To further support their learning, students can conduct shared research using trade books and online resources in order to learn more about physical changes to matter.

After reading informational texts and conducting investigations, students should be able to write opinion pieces in which they state an opinion, supply evidence to support their opinion, use linking words to connect opinion to evidence (reasons), and provide a concluding statement. For example, students can be presented with an example of matter that has been changed in some way, then asked to write an opinion piece in which they state whether or not they think the change is reversible or irreversible, and supply evidence to support

their thinking. Evidence can include information recalled from experiences or information gathered from informational texts or other resources. Some possible changes that can be used are:

- Tearing paper
- Bending a spoon
- Baking a cake
- Hammering a nail into a piece of wood
- Getting grass stains on a pair of jeans
- Cutting your hair.

Future learning

The following disciplinary core ideas are future learning for the concepts in this unit of study.

In Grade 4, students will know that

- 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.

In Grade 5, students will know that

- 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 that shows that gases are made from matter particles that are too small to see and that 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.
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
- 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).
- When two or more different substances are mixed, a new substance with different properties may be formed.
- 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).
- 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 their 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.

Number of Instructional Days

Recommended number of instructional days: 15 (1 day = approximately 45–60 minutes)

Note—The recommended number of days is an estimate based on the information available at this time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.

