

2-PS1-1 Matter and Its Interactions

Students who demonstrate understanding can:

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.** [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. 	PS1.A: Structure and Properties of Matter <ul style="list-style-type: none"> Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. 	Patterns <ul style="list-style-type: none"> Patterns in the natural and human designed world can be observed.

Observable features of the student performance by the end of the grade:

1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon under investigation, which includes the following idea: different kinds of matter have different properties, and sometimes the same kind of matter has different properties depending on temperature.
	b	Students identify and describe* the purpose of the investigation, which includes answering a question about the phenomenon under investigation by describing* and classifying different kinds of materials by their observable properties.
2	Identifying the evidence to address the purpose of the investigation	
	a	Students collaboratively develop an investigation plan and describe* the evidence that will be collected, including the properties of matter (e.g., color, texture, hardness, flexibility, whether it is a solid or a liquid) of the materials that would allow for classification, and the temperature at which those properties are observed.
	b	Students individually describe* that: <ul style="list-style-type: none"> The observations of the materials provide evidence about the properties of different kinds of materials. Observable patterns in the properties of materials provide evidence to classify the different kinds of materials.
3	Planning the investigation	
	a	In the collaboratively developed investigation plan, students include: <ul style="list-style-type: none"> Which materials will be described* and classified (e.g., different kinds of metals, rocks, wood, soil, powders). Which materials will be observed at different temperatures, and how those temperatures will be determined (e.g., using ice to cool and a lamp to warm) and measured (e.g., qualitatively or quantitatively). How the properties of the materials will be determined. How the materials will be classified (i.e., sorted) by the pattern of the properties.
	b	Students individually describe* how the properties of materials, and the method for classifying them, are relevant to answering the question.
4	Collecting the data	
	a	According to the developed investigation plan, students collaboratively collect and record data on the properties of the materials.

2-PS1-2 Matter and Its Interactions

Students who demonstrate understanding can:

- 2-PS1-2.** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. 	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> Different properties are suited to different purposes. 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Simple tests can be designed to gather evidence to support or refute student ideas about causes. <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Influence of Engineering, Technology, and Science, on Society and the Natural World</p> <ul style="list-style-type: none"> Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

Observable features of the student performance by the end of the grade:

1	Organizing data	<p>a Using graphical displays (e.g., pictures, charts, grade-appropriate graphs), students use the given data from tests of different materials to organize those materials by their properties (e.g., strength, flexibility, hardness, texture, ability to absorb).</p>
2	Identifying relationships	<p>a Students describe* relationships between materials and their properties (e.g., metal is strong, paper is absorbent, rocks are hard, sandpaper is rough).</p> <p>b Students identify and describe* relationships between properties of materials and some potential uses purpose (e.g., hardness is good for breaking objects or supporting objects; roughness is good for keeping objects in place; flexibility is good to keep a materials from breaking, but not good for keeping materials rigidly in place).</p>
3	Interpreting data	<p>a Students describe* which properties allow a material to be well suited for a given intended use (e.g., ability to absorb for cleaning up spills, strength for building material, hardness for breaking a nut).</p> <p>b Students use their organized data to support or refute their ideas about which properties of materials allow the object or tool to be best suited for the given intended purpose relative to the other given objects/tools (e.g., students could support the idea that hardness allows a wooden shelf to be better suited for supporting materials placed on it than a sponge would be, based on the patterns relating property to a purpose; students could refute an idea that a thin piece of glass is better suited to be a shelf than a wooden plank would be because it is harder than the wood by using data from tests of hardness and strength to give evidence that the glass is less strong than the wood) .</p> <p>c Students describe* how the given data from the test provided evidence of the suitability of different materials for the intended purpose.</p>

2-PS1-3 Matter and Its Interactions

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 expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
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. 	PS1.A: Structure and Properties of Matter <ul style="list-style-type: none"> Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces. 	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.

Observable features of the student performance by the end of the grade:

1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates the given phenomenon to a scientific idea, including that an object made of a small set of pieces can be disassembled and made into a new object.
	b	Students use evidence and reasoning to construct an evidence-based account of the phenomenon.
2	Evidence	
	a	Students describe* evidence from observations (firsthand or from media), including: <ol style="list-style-type: none"> The characteristics (e.g., size, shape, arrangement of parts) of the original object. That the original object was disassembled into pieces. That the pieces were reassembled into a new object or objects. The characteristics (e.g., size, shape, arrangement of parts) of the new object or objects.
3	Reasoning	
	a	Students use reasoning to connect the evidence to support an explanation. Students describe* a chain of reasoning that includes: <ol style="list-style-type: none"> The original object was disassembled into its pieces and is reassembled into a new object or objects. Many different objects can be built from the same set of pieces. Compared to the original object, the new object or objects can have different characteristics, even though they were made of the same set of pieces.

2-PS1-4 Matter and Its Interactions

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 expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<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).</p> <ul style="list-style-type: none"> Construct an argument with evidence to support a claim. <p>Connections to Nature of Science</p> <p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</p> <ul style="list-style-type: none"> Science searches for cause and effect relationships to explain natural events. 	<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. 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Events have causes that generate observable patterns.

Observable features of the student performance by the end of the grade:

1	Supported claims
	a Students make a claim to be supported about a phenomenon. In their claim, students include the idea that some changes caused by heating or cooling can be reversed and some cannot.
2	Identifying scientific evidence
	a Students describe* the given evidence, including: <ul style="list-style-type: none"> i. The characteristics of the material before heating or cooling. ii. The characteristics of the material after heating or cooling. iii. The characteristics of the material when the heating or cooling is reversed.
3	Evaluating and critiquing the evidence
	a Students evaluate the evidence to determine: <ul style="list-style-type: none"> i. The change in the material after heating (e.g., ice becomes water, an egg becomes solid, solid chocolate becomes liquid). ii. Whether the change in the material after heating is reversible (e.g., water becomes ice again, a cooked egg remains a solid, liquid chocolate becomes solid but can be a different shape). iii. The change in the material after cooling (e.g., when frozen, water becomes ice, a plant leaf dies). iv. Whether the change in the material after cooling is reversible (e.g., ice becomes water again, a plant leaf does not return to normal).
	b Students describe* whether the given evidence supports the claim and whether additional evidence is needed.
4	Reasoning and synthesis
	a Students use reasoning to connect the evidence to the claim. Students describe* the following chain of reasoning: <ul style="list-style-type: none"> i. Some changes caused by heating or cooling can be reversed by cooling or heating (e.g., ice that is heated can melt into water, but the water can be cooled and can freeze back into ice [and vice versa]).

		ii. Some changes caused by heating or cooling cannot be reversed by cooling or heating (e.g., a raw egg that is cooked by heating cannot be turned back into a raw egg by cooling the cooked egg, cookie dough that is baked does not return to its uncooked form when cooled, charcoal that is formed by heating wood does not return to its original form when cooled).
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