

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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