

Unit 3: Connecting Places, Connecting People

WEEK 5 Lesson 2

**Science and Engineering: Physical Science**  
 Matter and Its Interactions: Reversible and Irreversible Changes  
 Are all changes in matter reversible?

<b>S &amp; E Big Ideas</b>	Matter changes states when it is cooled or heated. Some changes of matter are reversible and some are not.						
<b>S &amp; E Guiding Question</b>	Are all changes in matter reversible?						
<b>Content Objective</b>	I can make a claim about whether a change I observe is reversible or irreversible and support that claim with evidence. (2-PS1-4, Practice 7)						
<b>Language Objective</b>	I can describe why a change in matter is or is not reversible. (SL.3.2.a, SL.4.2)						
<b>Vocabulary</b>	<b>irreversible:</b> unable to be returned to its previous state <b>reversible:</b> able to be returned to its previous state, the way it was before						
<b>Materials and Preparation</b>	<ul style="list-style-type: none"> <li>● Changing States of Matter chart, from previous weeks</li> <li>● <a href="https://www.youtube.com/watch?v=_3c4xYl-o2o">How to Make Tomato Sauce</a> video (https://www.youtube.com/watch?v=_3c4xYl-o2o)</li> <li>● projector and screen</li> <li>● chart paper and markers</li> </ul> <p>Prepare the following chart, with about ten lines.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 50%;">Change in matter</th> <th style="width: 50%;">Reversible or irreversible? How do we know?</th> </tr> </thead> <tbody> <tr> <td style="height: 20px;"> </td> <td> </td> </tr> <tr> <td style="height: 20px;"> </td> <td> </td> </tr> </tbody> </table> <p>Explanatory notes:                      A <u>chemical</u> change produces a new material with different properties than the original material(s). For example, a chemical change occurs with heat,</p>	Change in matter	Reversible or irreversible? How do we know?				
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	<p>as in making tomato sauce. A chemical change also occurs when materials interact with each other and make a new product, as in making a cake. A chemical change alters the material at the molecular level. Chemical changes are <i>irreversible</i>.</p> <p>A <u>physical</u> change does not change the material at the molecular level. Some actions do not create a change in the material itself but simply alter its size, shape, volume, or temperature. Ice melting involves a change from a solid to a liquid, and the substances maintain the properties of water because the molecules never change. Water boiling is also a physical change: as water molecules vibrate faster, they enter the gas phase and become water vapor. Physical changes are <i>reversible</i>.</p> <p>To differentiate: Something that is heated slightly and cooled to its original state constitutes a physical (reversible) change (for example, heating oil), while something that is heated enough to change its form and is combined with other ingredients to make something new constitutes a chemical (irreversible) change. Note that dissolving is also a reversible, physical change, because nothing is changed at the molecular level.</p>
<p><b>Opening</b> 1 minute</p>	<p><i>Last week we determined that we can turn ice, a solid, into water, a liquid, and back into ice, a solid. We have also seen that we can turn water vapor, a gas, back into water, a liquid.</i></p> <p>Harvest children’s recollections about experiences with changes in states of water, referring to the Changing States of Matter chart.</p> <p><i>All those changes were <b>reversible</b>: we were able to turn the water back to the way it was before—an ice cube—and the water vapor back into water.</i></p> <p><i>Today we will think about whether <u>all</u> changes of matter are reversible, like these were.</i></p>
<p><b>Investigation and Discussion</b> 28 minutes</p>	<p><i>Let’s think of changes in matter that we might see in everyday life.</i></p> <p>Give an example and discuss the process of change. For example:</p> <ul style="list-style-type: none"> <li>● <i>The other day I baked a cake for my friends: I used flour, sugar, eggs and milk, and I changed all these ingredients into a cake. I mixed everything together, put it in the oven and baked it. After that, I couldn’t turn the cake back into separate ingredients—flour, eggs, sugar, milk, and butter—because those had interacted with each other to make something new. That is an <b>irreversible</b>, or not reversible, change.</i></li> <li>● <i>This morning I folded paper to make a card for my friend. When I did</i></li> </ul>

*this, the size and shape of the paper changed, but the paper is still paper. Folding is a **reversible** change because the paper hasn't changed its state or become something new. I can unfold the paper again, and it will be just like when I started.*

Have the children turn and talk to a partner about changes in matter that they experience.

*What changes in matter have you experienced?*

*As you talk with your partner, ask yourselves: Can the matter that changed be turned back into what it was before?*

As children talk with partners, circulate to support their conversations. As needed, offer additional ideas, such as:

- heating frozen soup or other foods, watching ice cream melt, freezing water to make ice cubes, mixing together beans and rice (all reversible)
- burning toast, cooking pancakes, frying eggs, boiling and mashing potatoes, making popcorn (all irreversible)

After a few minutes, ask children to share their ideas, and record a few of them on the class chart (leaving four lines blank for the next part of the lesson). As children assert whether a change is reversible or irreversible, encourage them to explain their thinking.

*This is a tricky idea to understand and explain, so use careful and precise words. If you don't understand what someone is saying, ask them to say it again in another way so we all understand.*

Change in matter	Reversible or irreversible? How do we know?
Baking a cake	Irreversible: combining and heating ingredients creates a new food that cannot be returned to separate ingredients again
Melting popsicles	Reversible: popsicles can be frozen again
Doing laundry	Reversible: wet clothes can dry; clean clothes can get dirty again

*By looking at our chart, we can say that some changes of matter are **reversible** and some are not—they are **irreversible**. What do you think makes a change of matter irreversible? (Heat may be the cause for some of the irreversible changes children propose.)*

	<p><i>Let's watch a video about making tomato sauce.</i> Watch the video once through without stopping.</p> <p><i>What changes did you see in making tomato sauce?</i> Harvest a few ideas.</p> <p>Watch the video a second time, stopping at the indicated places to identify changes and discuss whether they are reversible or irreversible and what makes them so. Add these examples to the chart.</p> <table border="1" data-bbox="454 588 1396 1365"> <thead> <tr> <th><b>stop at minute:</b></th> <th><b>change:</b></th> <th><b>reversible/irreversible?</b></th> </tr> </thead> <tbody> <tr> <td>0:38</td> <td>slice and cut vegetables</td> <td>Reversible: The pieces are smaller, but there are no changes in matter.</td> </tr> <tr> <td>0:59</td> <td>heat up garlic</td> <td>Irreversible: The garlic is cooked and cannot be returned to its raw form.</td> </tr> <tr> <td>1:02</td> <td>heat up the tomatoes</td> <td>Irreversible: The tomatoes are cooked and cannot be returned to their raw form. This is different from chopping them.</td> </tr> <tr> <td>1:22</td> <td>Stir and blend thoroughly</td> <td>Irreversible: Heat changed all the ingredients from raw to cooked, the ingredients interact with each other, and they cannot be returned to their original state.</td> </tr> </tbody> </table>	<b>stop at minute:</b>	<b>change:</b>	<b>reversible/irreversible?</b>	0:38	slice and cut vegetables	Reversible: The pieces are smaller, but there are no changes in matter.	0:59	heat up garlic	Irreversible: The garlic is cooked and cannot be returned to its raw form.	1:02	heat up the tomatoes	Irreversible: The tomatoes are cooked and cannot be returned to their raw form. This is different from chopping them.	1:22	Stir and blend thoroughly	Irreversible: Heat changed all the ingredients from raw to cooked, the ingredients interact with each other, and they cannot be returned to their original state.
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<p><b>Closing</b> 1 minute</p>	<p><i>Today we noticed that not all changes of matter are reversible like the ones we have investigated with water. We noticed that sometimes we can change matter into new kinds of matter—for example, if we cook something or combine ingredients to make something new.</i></p>															
<p><b>Standards and Practices</b></p>	<p><b>SL.3.2.a</b> Describe people, places, and things, tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences.</p> <p><b>SL.4.2</b> Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification.</p>															

	<b>2-PS1-1.</b> Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
<b>Ongoing assessment</b>	Reflect on the class discussions and the ideas recorded on the chart. What language do children use to explain their thinking and to describe changes they observe? How do children provide detail and clarification as they speak and answer each other's questions? How do children explain reversible and irreversible changes?

**Notes**