

NGSS 3 Dimensional Lesson Concept: Plan and conduct an investigation around heating or cooling substances to generate observable patterns of reversible and irreversible changes.

SEP SEP3 - Planning and Carrying Out Investigations: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

SEP7 - Engaging in Argument From Evidence: Construct an argument with evidence to support a claim.

DCI PS1.A - Structure and Properties of Matter: 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.

PS1.B - Chemical Reactions: 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)

CCC CCC2 - Cause and Effect: Students learn that events have causes that generate observable patterns.

Success Criteria:

- I can conduct an investigation to determine the effects of freezing and heating food.
- I can explain the difference between reversible and irreversible changes.
- I can identify patterns in data.

Anchor Phenomenon: The properties of food can change. ([1 Minute Mug Pizza](#))

Lesson Investigative Phenomenon: Materials can change properties when heated or frozen.

Question to Investigate: How can we change food?

ELD Language Target: Describe ideas and phenomena.

Key Vocabulary: reversible, irreversible, freeze, thaw, heat, cool

Habit of Mind #10: Gather Data through All Senses: Enjoys hands-on learning experiences. Is aware of the world around them. (I can learn about the world around me!)

Materials Needed		Seesaw Activities	Prepare
• Resource Slides • 1 loaf of bread: ◦ 6 slices of normal bread ◦ 6 slices of bread that have been frozen and thawed ◦ 6 slices of toasted bread • Vocabulary Cards: reversible, irreversible	• Song: The Heating & Cooling Song • Notebook page: Changing Food Investigation • Final Product Step: Mix It Up! Recipe #2 • Extension Epic Books: Microwave Ovens, Cooking	• Changing Food • Mix It Up! Recipe #2	• Select students' Exit Slips to share with the class. • Record 4 properties of the bread before freezing on the Example: Changing Food Investigation notebook page. • Freeze 6 pieces of bread the night before this lesson. • Toast 6 pieces of bread the day of the lesson or during class. • Note: This lesson asks students to freeze and thaw, and heat and cool foods at home. Send the Family Email: Changing Food Investigation to notify parents.

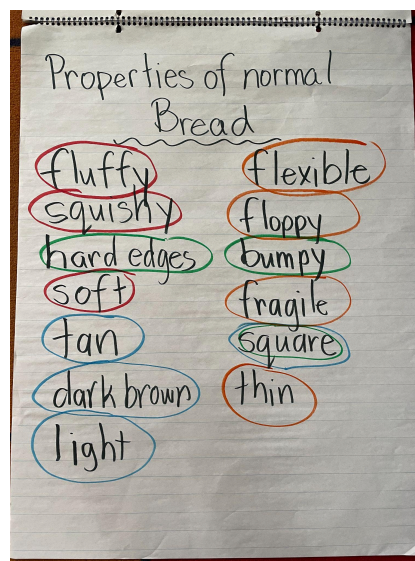
Stage	Teacher Does	Student Does
Lesson 6 Launch/ Engage 4 min.   	SESSION 1 <i>Scientists, we've been learning about different things that food can do. After each lesson, you've been writing what you have learned about what food can do. Turn and talk: What can food do?</i> Read selected Exit Slips to the class. Invite students to think about what their partner just said and if there is anything missing from the list of responses. <i>Scientists, today we are going to continue to explore what food can do by exploring how food can change. Our question to investigate is: How can we change food?</i> <i>Think about the food you eat at home and at lunch. How have you changed food?</i> Provide students independent think time, then invite students to turn and talk. Revoice the ways students have changed food to the class. Note: If students need more guidance in thinking about how they have changed food, invite students to think about the properties of food. Possible follow up questions: How have you changed the properties of food? How have you changed the size, shape, color, or texture of food? <i>Thank you for sharing your examples of how you've changed food.</i> DCI - PS1.A: Structure and Properties of Matter DCI - PS1.B: Chemical Reactions <i>Let's start investigating our question by thinking about a slice of bread. This is an ordinary slice of bread. Before we think about changing it, we want to have a detailed description of how it is now.</i>	Students turn and talk to share what food can do. (1 minute) Students listen to their classmates' responses of what food can do and share if there is anything missing from the list of responses. (2 minutes) Students turn and talk to share their prior experiences with changing food. (1 minute) Expected Student Responses • I have stirred ice cream to make it more creamy and smooth. • I have cut an apple into pieces.
Lesson 6 Explore/ Explain 60 min. 		



Let's describe its properties, so we have a record of exactly what it was like before we try to change it. Send students to their tables. Distribute a slice of bread to each group. Encourage students to use their Habit of Mind of gathering data with all of their senses. Invite students to observe, feel, and smell the bread and discuss in their groups how they would describe its properties. Roam the room and record properties students say to share with the class.

Write the words on index cards and place them in a pocket chart. Review the properties list that was generated by groups and invite students to share any properties that are missing.

Figure 6.1

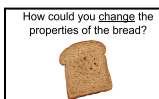
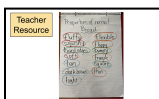


Guide students in an "open sort".

Which of these words go together?

Move the words on the pocket chart as students put them in categories.

Once the words are sorted, guide students to name the category for each list. For example, fluffy, squishy, and soft could be the category "texture". If students are having trouble coming up with categories, review the Properties Bank categories of texture, shape, color, size, etc. See example of an open sort in Figure 6.1.



Now think, how could you change the properties of this bread? Provide students independent think time. **Turn and talk: How could you change the properties of the bread?**

Excellent thinking, scientists!

Call the students back to the carpet.

Revoice how groups said they could change the bread to the class.

Remove the normal piece of bread from students' tables and save for later in the investigation.

Groups receive a normal piece of bread. Students use their senses to describe the properties of the bread. (3 minutes)

Students review the properties that were generated by groups and share any properties that are missing. (2 minutes)

Students conduct an open sort with the properties. They group properties that go together into categories. They name the categories after all the properties have been grouped. (5 minutes)

Groups discuss ways they could change the properties of the bread in groups. (2 minutes)

Expected Student Responses

- Cut it, toast it, leave it out to stale and make croutons, put butter on it, make it into a sandwich, mold it into a ball, etc.



Last night, I did an experiment at home to see if I could change the bread. I put 6 pieces of bread into the freezer, and I made a prediction. I thought that if I put them in the freezer that I would change them. I took them out this morning and saw that I did change them! They were no longer soft. Instead, they were hard. Their temperature also changed. They were cool to the touch. Before freezing them, they were bendable or malleable, but after freezing they changed. I could no longer bend them.



I left them out to show you the changes that happened, and guess what?! I can bend them again! I am going to pass out the 6 pieces of bread I froze and have now thawed to your tables. Share what you notice about the properties of the bread in your groups.



Invite students to share their observations with the class. Introduce the Page 1 of the [Example: Changing Food Investigation](#). Go down the list of properties that students used to describe the normal bread and record if the property stayed the same after freezing. (Only the teacher will provide input on the properties after freezing). Then, ask for students input if the properties stayed the same after thawing and record their responses.

Example:

Food	Properties Before Freezing	After Freezing		After Thawing		Claim
	1. fluffy	YES	NO	YES	NO	REversible IRreversible
	2. soft	YES	NO	YES	NO	
	3. light brown	YES	NO	YES	NO	
	4. square	YES	NO	YES	NO	

Use our data as evidence. Were the properties of the bread the same after thawing?



So the bread did change when it was frozen, but it went back to its normal properties after thawing.

Scientists call this kind of change a reversible change.

RE is a prefix that means again or back. The frozen bread went back to its original form and properties. Circle "Reversible" on the notebook page.

Groups describe the properties of the thawed bread. (2 minutes)

Students share whether the properties of the bread were the same after thawing. (2 minutes)

What other reversible changes can you think of? What can change and then go back to normal again? Invite students to turn and talk. Revoice students' thinking to the class.

Review the example of freezing water as a reversible change if it was not brought up by a student.

Freezing bread is a reversible change, but what do you think will happen if we heat the bread? Turn and talk: Do you think heating the bread will be a reversible change or not? What makes you think that? Listen to students' conversations. Revoice student thinking to the class.

I brought in 6 pieces of bread that I toasted. Describe the properties of the toasted bread in your groups.

Return to the [Example: Changing Food Investigation](#). Go down the list of properties that students used to describe the normal bread and record if the property stayed the same after heating and cooling.

Example:

Food	Properties Before Heating	After Heating		After Cooling		Claim
	1. fluffy	YES	NO	YES	NO	REversible IRreversible
	2. soft	YES	NO	YES	NO	
	3. light brown	YES	NO	YES	NO	
	4. square	YES	NO	YES	NO	

Scientists, is there any way we can get the toast to look normal again? Demonstrate trying to scrape off the dark colors of the bread. Think through freezing the bread out loud, highlighting that no matter what you do to the toasted bread it will not go back to normal.

Scientists call changes that cannot be undone irreversible changes. IR is a prefix that means not or no. An irreversible change is not reversible, meaning it cannot go back to its original form or state. There is no way we can change this bread back to have its original properties.

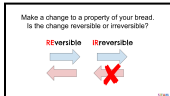
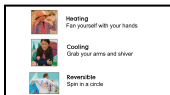
Students turn and talk to share reversible changes. (1 minute)

Students turn and talk to share what they think will happen when the bread is heated. They share if they think it will be a reversible change or not and what makes them think that. (1 minute)

Groups describe the properties of toasted bread. (2 minutes)

Students share whether the properties of the bread were the same after heating and cooling. (2 minute)

Students share if they think there is a way to make the toast go back to normal bread again. (1 minute)



Movement Break: Let's reinforce what we just learned with a song. There will be a few different movements you will see in this song. Invite students to stand up and practice heating, cooling, and reversible movements. Play [The Heating & Cooling Song](#) and move with the lyrics.

ELD Language Target: Describe ideas and phenomena.

Scientists, we know that heating and cooling can cause reversible and irreversible changes. We do not have the tools to heat or cool our bread in class.

Discuss with your group a way that you could change a property of the bread. Decide on the change together and then conduct the change. Then decide if you have made a reversible or irreversible change. We will share our changes and our claims of whether or not they are reversible or irreversible with the class in __ minutes. Encourage groups to think about all the ways they could change the bread, then decide on one way to change the bread. Pass the normal bread to groups and invite students to make their change when group members have agreed on what to do.

SEP7 - Engaging in Argument From Evidence

Call students back to the carpet. Invite students to present their change to the class and make a claim of whether the change is reversible or irreversible.

Note: Showing the group's change under the document camera will allow all students to easily see and think about the change.

Invite students to agree or disagree and explain why. Record the changes students made on a chart as they present. Example Chart:

Property Change	How	Claim	Response
Size	Cut in pieces	Irreversible	Agree
Color	Colored with a marker	Irreversible	Agree
Shape	Rolled into ball	Irreversible	Agree

Students learn the movements in the song. (Heating - fan yourself; Cooling - grab your arms and shiver; Reversible - spin in a circle.) Students move with the [The Heating & Cooling Song](#). (2 minutes)

Groups decide on a property of the bread to change. They conduct the change and then determine if it is reversible or irreversible. (4 minutes)

Groups present their bread and claims to the class. The class shares if they agree or disagree with their claim and why. (10 minutes)

Expected Student Responses (ESR)

- Our change is irreversible because we cannot make the bread one piece again.
- Our change is irreversible because we cannot change it back to its original color.
- Our change is irreversible because we can not make it flat again.

CCC2 - Cause and Effect

Invite students to notice patterns in their claims. There might be a pattern of more irreversible than reversible changes.

SEP3 - Planning and Carrying Out Investigations

Scientists, you made a lot of physical changes to the properties of the bread. At home, you do have access to tools that heat and freeze food. So we are going to continue our investigations at home! You're going to conduct an investigation around what happens when we change food. You will choose 1 food to freeze and thaw and 1 food to heat and cool. It is important that you ask an adult if it is okay if you freeze and heat the food first and to ask them to supervise or to do it with you. Discuss how to engage in the investigation and complete the [Changing Food Investigation](#) or [Seesaw Activity](#).

Note: Reinforce the importance of having an adult supervise during this home investigation. Ensure students understand that it is not safe to put fresh eggs in the microwave. Send home the [Family Email: Changing Food Investigation](#) to engage families in their child's investigation.

Invite students to think of a food they would like to freeze and heat and make predictions of whether they think it will be a reversible change or irreversible. **Turn and talk: What foods are you interested in heating and freezing? Share your predictions of whether they will be reversible changes or irreversible changes and what makes you think that.**

When we return for our next STEAM lesson, we will share our investigations and look for patterns in the number of reversible or irreversible changes. Let's make a quick prediction as a class. Do you think there will be more reversible or irreversible changes? Invite students to vote. Record the vote to return to in the next session.

Students identify patterns in the types of changes they made (more reversible or irreversible). (2 minutes)

Students turn and talk to share the foods they would like to heat or freeze and their predictions of whether they will be reversible or irreversible changes. (1 minute)

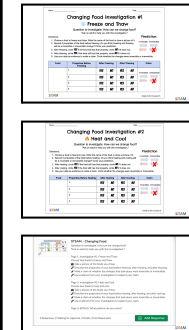
Students conduct investigations at home to determine the effects of freezing and heating foods. Students complete [Changing Food Investigation](#) or [Seesaw Activity](#). (at home)

SESSION 2

CCC2 - Cause and Effect

Invite students to share the results of their [Changing Food Investigation](#) with their groups.

Students share the results of their investigations of freezing and heating foods in groups. (5 minutes)





Collect data on the number of reversible and irreversible changes students reported for freezing and thawing food and heating and cooling food. Invite students to add a sticky or dot to a class chart to record their results. This will create a picture graph of student data about their foods.

❄️ Freezing and Thawing		🔥 Heating and Cooling	
Reversible	Irreversible	Reversible	Irreversible

How can we organize these stickies/dots so it is easy for us to compare the data about food changes?

Example: Students might say to put the stickies in a long line (like a bar graph), organize them into friendly groups like 5 or 10, etc.

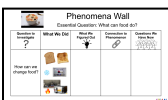
What patterns do you notice in our data about food changes?

There are more/fewer ____ than ____.

Example: There are more reversible changes for freezing and thawing than there are for heating and cooling.

Students collect and analyze data on the number of reversible and irreversible changes for freezing and thawing and for heating and cooling food. Students add a sticky or dot to a class chart and then look for patterns in the data. (8 minutes)

Lesson 6
Reflect/
Evaluate
15 min.



Scientists, we have been investigating the question: How can we change food? We started by thinking about a piece of bread and how we could change it, then each of you created your own investigations at home. What did you figure out about how we can change food?
Add student thinking to the Phenomena Wall.

Students share what they figured out about how we can change food. (2 minutes)

Expected Student Responses (ESR)

- We can change the properties of food by heating and freezing food. The changes can be reversible or irreversible.



Return to the anchor phenomenon. **Scientists, all of the learning we are doing about food is to help us understand and explain our anchor phenomenon of the one minute mug pizza.**

Let's watch how the one minute mug pizza is made again. As you watch, think about how the ingredients change when it is heated and if the changes are reversible or irreversible. Play [1 Minute Mug Pizza](#).



How did the ingredients change after the one minute mug pizza was heated? Do you think the changes are reversible or irreversible? What makes you think that? Add student thinking to the Phenomena Wall.

What questions do you have now about the one minute pizza and how it is made? Record students' questions on the Phenomena Wall.



Scientists, you have learned a lot more about food today! Our essential question is: "What can food do?" Think about what you learned today that food can do. Turn and talk: What can food do? Provide students with the sentence starter: Food can _____. Listen to students' conversations. Revoice students' sentences to the class.



Invite students to record their sentences in their Science Notebook, on the [Lesson 6 Exit Slip](#), or the [Food Can Seesaw Activity](#).



Return to the "What We Think We Know About Food" chart that was created in Lesson 1 and revised in Lesson 4. Invite students to change or add new thinking to the chart.

Students connect their learning to the anchor phenomenon. (2 minutes)

Expected Student Responses (ESR)

- The 1 minute pizza ingredients changed when it was heated in the microwave.
- Melting the cheese is reversible. It can turn back into a solid.
- Cooking the dough is irreversible. It cannot go back to dough again.

Students turn and talk to share what food can do. (1 minute)

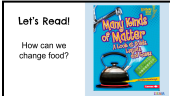
Expected Student Responses

- Food can change properties.
- Food can go through reversible changes like when water is frozen and then melts to become water again.
- Food can go through irreversible changes like when bread is heated to make toast.

Students record their responses in their Science Notebook, on the [Lesson 6 Exit Slip](#), or the [Food Can Seesaw Activity](#). (5 minutes)

Students review the "What We Think We Know About Food" chart and change or add new thinking. (3 minutes)

Lesson 6 Literacy Extension 11 min. 	<i>Chefs, when we create our recipes, we need to be able to tell others what to do. In writing, action words or verbs help others know what to do.</i> <i>Let's read the Epic book, Cooking to look for cooking verbs.</i> After identifying the verbs throughout the book (adds, makes, mixes, cooks, bakes, heats, melts, puts, freezes, boils, turns), invite students to look for the verbs they used in Recipe #1. Create a Cooking Verbs class bank.	Students identify verbs in the Epic book, Cooking. (5 minutes) Students look for verbs in Recipe #1. (4 minutes) Students contribute verbs to a class bank. (2 minutes)
Lesson 6 Final Product Step #2 35 min.   	Final Product Step #2 <i>One of the main goals of our project is to learn about each other. We are learning about each other through the foods we like.</i> Display Mix It Up! Recipe #2 or Seesaw Activity. <i>For our second recipe challenge, we are going to interview a friend or a family member to learn about their food preferences and then we are going to try to make them a new recipe based on the foods they like. We are creating multiple recipes to help us decide on one recipe that we want to add to our class cookbook.</i> <i>Interview a family member or friend. Ask: What foods do you like to eat? Record who you interviewed and the foods they like to eat. Then, imagine different combinations of food you could make that they might like. For instance, if they like sushi and they like tacos, you could make sushi tacos!</i> <i>Plan the ingredients and create the directions for how to make the dish. If you can, try to actually create the new dish. Think about how you might improve it, then share the dish with your family member or friend. What do they think? Do they like it or would they like to try it? Why or why not?</i> Encourage students to use verbs from the class bank as they are writing the steps for their recipes. Set a deadline for when the recipe should be finished.	Students interview a family member or friend about what foods they like to eat. (5 minutes) Students use the Design Thinking Process to create a new recipe based on what they learn from their interview. Students record their recipes using Mix It Up! Recipe #2 or Seesaw Activity. (30 minutes)

Lesson 6 Literacy Extension 	Reinforce students' knowledge of matter by reading Many Kinds of Matter: A Look at Solids, Liquids, and Gases. Invite students to observe their family members cooking and to take note of the states of matter they see in their kitchen. Invite students to share the states of matter they observed with the class.	Students read Many Kinds of Matter: A Look at Solids, Liquids, and Gases. Students observe family members cooking and record the states of matter they see in their kitchen. Students share states of matter they observed with the class.
Lesson 6 Literacy Extension 10 min. 	<i>Chefs, how many many of you have used a microwave?</i> Invite students to raise their hand to show if they have used a microwave before. <i>Turn and talk: What have you heated in a microwave?</i> <i>Microwaves sometimes feel like magic. You put food in and a minute later it comes out warm. However, it's not magic that heats your food. It's science!</i> <i>Let's learn more about microwaves and the science behind microwaves by reading the Epic book, Microwave Ovens. When we finish reading, we will turn and talk to share what we learned about microwaves.</i> <i>Turn and talk: What did you learn about microwaves?</i> Listen to students' conversations. Revoice what students learned to the class. Reinforce safety with microwaves and that metal should never be put in the microwave.	Students raise their hand if they have used a microwave. Students turn and talk to share what they have heated in a microwave. (1 minute) Students listen to the Epic book Microwave Ovens. (5 minutes) Students turn and talk to share what they learned about microwaves. (1 minute)
Lesson 6 Family Extensions  	<i>There are many resources online that you and your family can explore to find recipes to cook together.</i> Show students sources for looking at recipes: • Kids' "State Dinner" Cookbook • Rachel Ray's Yum-O Cooking Camp • America's Test Kitchen Kids <i>If you make a recipe with your family, we would love to hear about your experience and what you made!</i> <i>Watch the Sisters of Science Exploration of Reversible and Irreversible Changes: Lesson 2 - Reversible and Irreversible Change.</i> Invite students to record a video of an experiment they try at home.	Students explore resources online or find a recipe to cook with their family and share their recipe and experience in making it. Students watch Lesson 2 - Reversible and Irreversible Change. (4 minutes) Students record a video of an experiment they try at home.

Lesson 6 Phenomena Wall

Anchor Phenomenon: The properties of food can change. (1 Minute Mug Pizza)				
Essential Question: What can food do?				
Question to Investigate	What We Did	What We Figured Out	Connection to Phenomenon	Questions We Now Have
How can we change food?	We made observations of bread that had been frozen and thawed and heated and cooled. We changed the properties of bread. We investigated freezing and heating food at home.	Freezing and heating changes the properties of materials. Some property changes are reversible meaning they can go back to normal. Some property changes are irreversible meaning they cannot go back to normal.	The 1 minute pizza ingredients changed when it was heated in the microwave. Melting the cheese is reversible. It can turn back into a solid. Cooking the dough is irreversible. It cannot go back to dough again.	List questions students provide.

The Mix It Up! project was designed by Lacy Szuwalski and Zoë Randall in collaboration with the Instructional Technology Team, the VAPA Team, Sarah Mathy from the Math Team, and Janelle Manzano from SDUSD's Food and Nutrition Services. Special thanks to the Grade 2 Lesson Study team of Amy O'Leary, Eileen Moreno, Ginny McKelvy, and Ylianna Torres for collaborating and revising Session 1 of this lesson.

Please join the Unit 3 Curriculum Discussion at <https://forms.gle/xKk1nYHrvDLHbzbA8> to provide feedback on this lesson.