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Picture-Perfect
SCIENCE

Lessons, K-5 Using Children's
Books to Guide
Inquiry
by Emily Morgan and Karen Ansberry



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Freezing and Melting

Description

Frozen treats provide a familiar and fun context for learning about changes in matter. Through engaging read-alouds and some cool activities (pun intended) with Popsicles and ice cream, students learn about solids, liquids, freezing, and melting.

Suggested Grade Levels: K–2

LESSON OBJECTIVES *Connecting to the Framework*

PHYSICAL SCIENCES

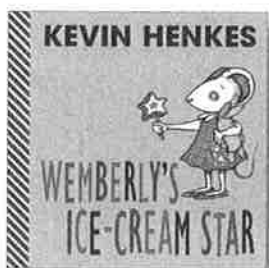
CORE IDEA PS1: MATTER AND ITS INTERACTIONS

PS1.A: STRUCTURE AND PROPERTIES OF MATTER

By the end of grade 2: Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either solid or liquid, depending on temperature.

PS1.B: CHEMICAL REACTIONS

By the end of grade 2: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible (e.g., melting and freezing), and sometimes they are not (e.g., baking a cake, burning fuel).



Featured Picture Books

TITLE: *Wemberly's Ice-Cream Star*

AUTHOR: Kevin Henkes

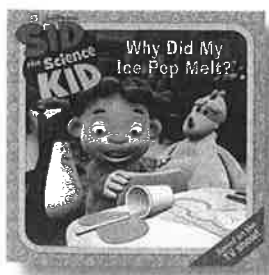
ILLUSTRATOR: Kevin Henkes

PUBLISHER: Greenwillow Books

YEAR: 2003

GENRE: Story

SUMMARY: *Wemberly wants to share her ice-cream star with Petal, so she waits until it melts and then makes ice-cream star soup for them to share.*



TITLE: *Why Did My Ice Pop Melt?*

AUTHOR: Susan Korman

PUBLISHER: HarperFestival

YEAR: 2010

GENRE: Narrative Information

SUMMARY: *Based on the PBS television series Sid the Science Kid, this book explains why things melt and introduces the concept of a reversible change.*

Time Needed

This lesson will take several class periods. Suggested scheduling is as follows:

Day 1: **Engage** with *Wemberly's Ice Cream Star* Read-aloud, **Explore** with Popsicle Soup: Part 1, and **Explain** with *Why Did My Ice Pop Melt?* Read-Aloud

Day 2: Liquid and Solid Demonstrations and Popsicle Soup: Part 2

Day 3: **Elaborate** with Ice Cream Ingredient Exploration and Making Ice Cream

Day 4: **Evaluate** with The Day We Made Ice Cream

Materials

For making Popsicle soup (per student)

- Store-bought or homemade freezer pop
- Bowl
- Spoon

For Liquid and Solid Demonstrations

- Food coloring
- Water
- Clear plastic bottle
- Clear container with a different shape from the bottle
- Pencil

For Making Ice Cream (per group of four students)

- 2 gallon-size zippered plastic bags (heavy duty)
- 1 quart-size zippered plastic bag (heavy duty)
- 4 cups ice
- $\frac{1}{4}$ cup salt
- 1 cup whole milk
- 1 teaspoon vanilla extract
- 2 tablespoons sugar
- 4 small cups
- 4 spoons
- 4 pairs of winter gloves (*Note:* If you ask students to bring these from home, be sure to have a few extras for anyone who forgets to bring them.)
- Hand lens
- Alternative treats for students with dairy allergies

SAFETY

- Check with the school nurse regarding student medical issues (e.g., allergies) and how to deal with them.
- Have students wash their hands with soap and water upon completing the activity (before and after when consuming food).
- When making food to be eaten (e.g., ice cream), make sure that all surfaces and equipment for making the food have been sanitized.
- When working with cool or cold liquids/solids, have students use appropriate personal protective equipment (PPE), including thermal gloves, eye protection, and aprons.

Student Pages

- Popsicle Soup
- The Day We Made Ice Cream (copy p. 62 back-to-back with p. 63)

Background

According to *A Framework for K–12 Science Education*, students should build some foundational ideas about matter and its interactions in the early years of school. Specifically, they should understand that different kinds of matter exist and that they can be different forms based on temperature. They should also have opportunities to observe that heating and cooling matter can cause changes; some of these changes are reversible (e.g., freezing and melting) and some are not (baking a cake, burning fuel). This lesson uses the familiar context of frozen treats to give students experience with solids, liquids, freezing, and melting and opportunities to use that vocabulary.

Making ice cream in the classroom is a fun way to explore freezing and melting. The main ingredients are simple: whole milk, sugar, and vanilla. The key is getting the ingredient mixture cold enough to become solid ice cream. In the lesson, we suggest you place all the ingredients in a quart-size zippered bag, and then place that bag into a gallon-size zippered bag containing ice and either rock salt or kosher salt. The salt lowers the freezing point of water from its usual freezing point of 0°C (32°F) to –2°C (28°F), making the ice-salt-water mixture in the outside bag much colder than if it were just ice alone. This very cold outer mixture causes the liquid milk mixture to freeze and become solid. Shaking the bag distributes the cold outer mixture so that it makes better contact with the inner bag.

engage

Wemberly's Ice-Cream Star Read-Aloud



Inferring

Connecting to the Common Core

Reading: Literature

KEY IDEAS AND DETAILS: K.1, 1.1, 2.1

Show students the cover of *Wemberly's Ice-Cream Star* and introduce the author/illustrator. *Ask*

- ? What do you think this story is going to be about? (Answers will vary.)

- ? Have you ever read any other books about Wemberly or any other books by Kevin Henkes? (Students may have read popular books by Kevin Henkes, such as *Wemberly Worried*, *Owen*, *Chrysanthemum*, or *Julius, the Baby of the World*.)



Questioning

Read the book aloud. *Ask*

- ? What happened to Wemberly's ice-cream star? (It melted.)
- ? Why did it melt? (It got warmer.)
- ? Why did Wemberly want her ice-cream star to melt? (She wanted to share it with Petal.)
- ? What is your favorite frozen treat?
- ? How many of you like Popsicles?
- ? Has anyone ever had Popsicle soup?

explore

Popsicle Soup: Part 1

Give each student the Popsicle Soup student page. Tell them that after they write their names at the top, they will receive a bowl and a Popsicle. *Ask*



POPSICLE "BEFORE"

- ? How can we make Popsicle soup? (Wait for the Popsicle to melt.)

On part 1 of the Popsicle Soup student page, have students draw a picture of the Popsicle in the "Before" section of the student page. Tell students that when they are finished with their drawing, they can take a small bite of their Popsicle and then come to the reading carpet or corner. *Ask*

- ? How did your Popsicle taste?
- ? What flavor was it?
- ? How did it feel on your tongue? (cold, hard)

Explain to students that you are going to read a story while they wait to eat their Popsicle soup.

explain

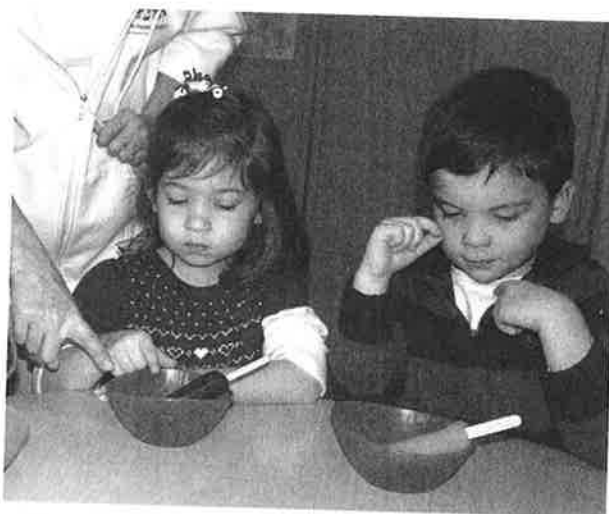
Why Did My Ice Pop Melt? Read-Aloud



Making Connections

Connecting to the Common Core
Reading: Informational Text

KEY IDEAS AND DETAILS: K.1, 1.1, 2.1



MAKING POPSICLE SOUP

Show students the cover of *Why Did My Ice Pop Melt?* and explain that "ice pop" is another name for a Popsicle. *Ask*

- ? Have you ever read a *Sid the Science Kid* book or seen the show on television?

Explain that the character Sid is a kid who is very curious about science.

Read the story aloud, stopping periodically to ask guiding questions, such as:

Page 4: What does "melted" mean? (turned into a liquid)

Page 5: Why do frozen things melt? (They get warmer.)

Page 9: Why aren't the ice pops ready yet? (They need more time to get colder.)

Page 14: Do you think it is possible to freeze liquid back into ice?

Page 15: What does the word *reverse* mean? (to go back) What is it called when something can change back and forth? (reversible change)

Page 17: What do you think Sid and his friends can do to make the ice melt faster? (Answers will vary but may involve making the ice warmer or breaking it in to smaller pieces.)

Page 21: Why did the water make the block of ice melt faster? (It was warm.)

Tell students to go back to their desks to check on their Popsicle soup. They should draw it in the “After” section of the student page. Tell them to raise their hand when they finish their drawing, and you will bring them a spoon so they can eat their Popsicle soup. Tell them they will be doing part 2 of the student page later.

Liquid and Solid Demonstrations

Connecting to the Common Core Language

VOCABULARY ACQUISITION AND USE: K.6, 1.6, 2.6

Reread page 14 of *Why Did My Ice Pop Melt?* where the teacher uses the word “liquid.” Then create a T-chart on the board with the word “liquid” on one side. *Ask*

? What is a liquid?

Do the following demonstration of a liquid:

Hold up a plastic bottle filled with colored water. Then hold up an empty clear container with a different shape. Ask students to predict what shape the colored water will take when you pour it into the other container. Demonstrate, and repeat a few times. Then explain that a liquid is a kind of matter that can pour, and that it takes the shape of whatever container it is in.

Ask

? What are some other examples of liquids? (milk, juice, and so on)

List correct student examples on the T-chart.

Ask

? Is a frozen Popsicle a liquid? (no)

? If it's not a liquid, what is it? (a solid)

Write the word “solid” on the other side of the T-chart. Then do the following demonstration of a solid:

Hold up a pencil and one of the empty clear containers. Ask students to predict what shape the pencil will take when you put it into the container. Demonstrate by placing the pencil into the container. Then explain that solids have their own shape and do not take the shape of the container they are in.

Ask

? What are some examples of solids? (ice, pencil, book, and so on)

List correct student examples on the T-chart.

Ask

? What is it called when something changes from a solid to a liquid? (melting)

? Can you think of other things that melt? (candles, chocolate, cheese, ice cream, and so on)

? How do you make things melt? (Add heat, make them warmer.)

Explain that some things do not melt when they are heated, but instead will burn if they get hot enough or set on fire. *Ask*

? Can you think of something else that doesn't melt when it is heated, but burns instead? (wood, paper, etc.)

Ask

? Would burning be a “reversible change”? (no)

? Why not? (It can't go back to what it was before.)

Popsicle Soup: Part 2

Tell the students to think back to when they ate their Popsicle soup. *Ask*

? Did the soup have the same flavor as the Popsicle? (yes)

? Did it feel the same in your mouth? (no)

? What was the difference? (It was liquid, it was runny, it was not as cold)



OBSERVING ICE CREAM INGREDIENTS

Explain that the Popsicle soup was still the same “stuff” they started with. It was just in a liquid form. *Ask*

- ? Would it be possible to turn the Popsicle soup back into a Popsicle? (yes)
- ? What would we have to do? (Freeze it.)
- ? What is that kind of change called, where it can change back and forth? (reversible change)

Next, have students complete part 2 of the Popsicle Soup student page by filling in the blanks with the correct words, so that the sentences read:

My Popsicle started out as a solid.

My Popsicle got warmer and turned into a liquid.

Changing from a solid to a liquid is called melting.

Encourage the students to take their papers home and explain to someone how they made Popsicle soup and read their completed sentences aloud to that person.

elaborate

In advance, ask each student to bring in a pair of winter gloves.

Ice Cream Ingredient Exploration

Ask

- ? How is ice cream made?
- ? Do you think we could make ice cream right here in our classroom?
- ? What materials do you think we would need to make ice cream right here, right now?

Have students explain their reasoning for each ingredient they suggest.

Tell students that you have the ingredients to make vanilla ice cream and you would like them to use their senses of sight and smell to figure out what they are. Give each group of four students small cups containing small amounts of sugar, vanilla, whole milk, and ice. Allow time for them to observe the ingredients, without tasting, and discuss what they might be. Then identify each substance and discuss its purpose. For example, sugar makes the ice cream sweet, vanilla adds flavor, ice makes it freeze.

Have the students sort the ingredients into two groups: liquid (milk and vanilla) and solid (ice and sugar). Students might have trouble determining if sugar is a solid or liquid because it pours,



MAKING ICE CREAM

so explain that some solids are so tiny that they can be poured. Have students observe one grain of sugar with a hand lens to see that it is a solid cube. It has its own shape, therefore it is a solid.

Making Ice Cream

- ? What do we need to do to turn this mixture into ice cream? (Make it cold.)

NOTE: The instructions in this activity are for making ice cream in groups of four. You may want to have parent volunteers help out or invite some older student "buddies" to help. If you are not able to get assistance, you can adapt this activity to be a demonstration.

- Measure the milk, vanilla, and sugar and place them into a small zippered bag for each group of four students. Squeeze out as much air as possible and seal the bag carefully and completely. Too much air left inside may force the bag open during shaking.
- Fill a gallon-size zippered bag about half full of ice and add $\frac{1}{4}$ cup of salt. Put this bag inside the other gallon-size zippered bag. (Double bagging is recommended to prevent leaks.) Explain to students that the salt is added to make the ice even colder.
- Place the small zippered bag down into a large zippered bag. Make sure the small bag is pushed down into the ice and salt. Seal the large bag tightly.
- The bag gets very cold, so have the students put on winter gloves.
- Give each team a bag and have them pass, shake, and flip the bag for about 10 minutes. Tell students not to open the large bag to check the ice cream because it may not seal properly afterward.
- Take the small bag out of the large bag of ice and wipe it off with paper towels to get the salt water off of the outside of the bag.
- Open the bag and spoon the ice cream into small

cups. (*Note:* To avoid getting salty water into the ice cream, it helps to fold the top of the small bag outward before scooping out the ice cream.)

Ask

- ? Should we eat our ice cream now? (Yes!)
- ? What would happen if we waited until later to eat it? (It would melt.)

Provide an alternative treat for students with dairy allergies, then allow everyone to enjoy their treats!

evaluate

The Day We Made Ice Cream



Writing

Connecting to the Common Core Writing

RESEARCH TO BUILD AND PRESENT KNOWLEDGE: K.7, 1.7, 2.7

Language

VOCABULARY ACQUISITION AND USE: K.6, 1.6, 2.6

Give each student a copy of The Day We Made Ice Cream student page. Have each student write the correct word to complete each sentence and then illustrate each sentence in the box. Encourage students to go back to each page and add more details to the story to make it more personal. For example, a student might add a description of how the ice cream tasted on the last page.

The sentences should read:

First we mixed milk, sugar, and vanilla in a bag. It was a liquid.

Next we added solid ice.

Then we shook the bag to make the liquid freeze into a solid.

Last we scooped out the solid ice cream.

We had to eat our ice cream before it melted.

Inquiry Place

Have students brainstorm questions about solids and liquids. Examples of such questions include

- ? Does the amount of a liquid affect how quickly it will freeze into a solid? Test it!
- ? Does the amount of a solid affect how quickly it will melt into a liquid? Test it!
- ? Does temperature affect how quickly a solid will melt into a liquid? Test it!
- ? How cold does the temperature have to be for water to freeze into a solid? Test it!

Then have students select a question to investigate as a class, or have groups of students vote on the question they want to investigate as a team. After they make predictions, have them conduct an experiment to test their predictions. Students can present their findings at a poster session or gallery walk.

More Books to Read

Gibbons, G. 2006. *Ice cream: The full scoop*. New York: Holiday House.

Summary: This informative book explains the history of ice cream and how it is made.

Hansen, A. 2012. *Matter comes in all shapes*. Vero Beach, FL: Rourke.

Summary: Simple text and photographs explain the differences between solids, liquids, and gases.

Hansen, A. 2012. *Solid or liquid?* Vero Beach, FL: Rourke.

Summary: Simple text and photographs explain the differences between solids and liquids.

Royston, A. 2008. *Solids, liquids, and gases*. Chicago, IL: Heinemann.

Summary: From the *My World of Science* series, this book introduces the three states of matter and their properties. It also includes information on freezing, melting, and dissolving.

Schuh, M. 2012. *All about matter*. Mankato, MN: Capstone Press.

Summary: Simple text and photographs provide a brief introduction to matter and its properties.

Willems, M. 2010. *Should I share my ice cream?* New York: Hyperion Books for Children.

Summary: From the *Elephant and Piggie* series, this book follows Gerald the elephant as he makes a big decision: Should he share his ice cream? He waits too long and it melts, but Piggie brings more and saves the day.

Zoehfeld, K. W. 1998. *What is the world made of? All about solids, liquids, and gases*. New York: HarperCollins.

Summary: From the *Let's-Read-and-Find-Out Science* series, this book gives examples of each state of matter and some simple activities that demonstrate the attributes of each.

Name: _____

Popsicle Soup

Part 1

Draw a picture of your Popsicle before and after it became Popsicle soup in the boxes below.

Before



After



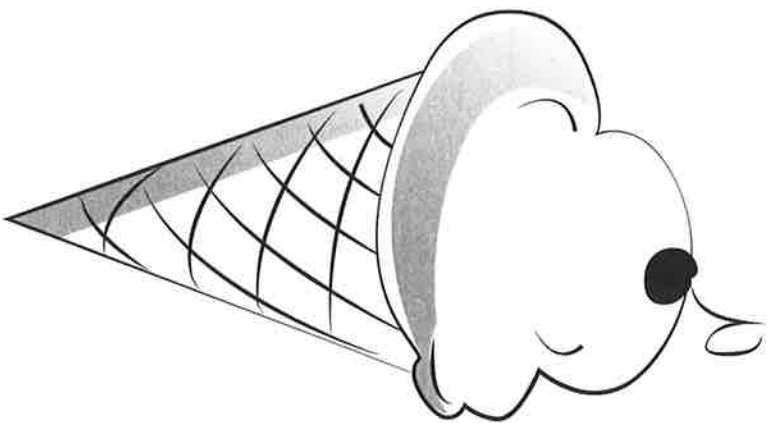
Part 2

My Popsicle started out as a _____.
(solid or liquid)

My Popsicle got warmer and turned into a _____.
(solid or liquid)

Changing from a solid to a liquid is called _____.
(freezing or melting)

The Day We Made Ice Cream



By _____

We had to eat our ice cream before it

_____.
(froze or melted)

First, we mixed milk, sugar, and vanilla
in a bag. It was a _____.
(solid or liquid)

Then, we shook the bag of ice to make
the liquid _____ into a solid.
(freeze or melt)

Next, we added _____ ice.
(solid or liquid)

Last, we scooped out the _____
ice cream.
(solid or liquid)