

Heat It Up, Cool It Down

Grade 2: Temperature Probe

Aligned with National Standards

overview

Demonstrate the effect of temperature on changes in matter caused by heating and cooling.

This inquiry activity is partially done in small groups and partially done as a whole class teacher led demonstration. Students observe the effects of heating and cooling substances. They will observe how heating and cooling substances changes the physical properties of the substances. This activity is set-up in two 20-30 minute lessons with an extension activity.

This activity uses the WARD's Single Temperature Probe to collect data, allowing students to focus on the science discovery and leaving more time for learning and developing higher level thinking skills. If you prefer, a simple thermometer can be used in this activity.

time requirement:

This activity can be completed in two lessons of 20 - 30 minutes each day.

materials required for the activity:

temperature probe or thermometer	water, ½ cup (room temperature)
hot plate	ice, ½ cup
freezer	egg, 1 (raw)
heat resistant containers (3)	egg, 1 (cooked)
oven mitt	butter, ¼ stick (solid)
Instructions (this guide)	butter, ¼ stick (melted)
and student worksheets (pages 8 & 9)	

safety precautions

general safety:

- Consider establishing a safety contract that students and their parents must read and sign. This is a good way to identify students with allergies (e.g., latex) so that you (and they) will be reminded of specific lab materials that may pose risks to individuals.
- Read all instructions before starting the lab activities, and remind students to ask questions about safety and safe laboratory procedures.
- Follow all hot plate safety procedures provided with the hot plate.
- Wash hands after this activity.



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DIMENSION 1 Science and Engineering Practices	X	Asking questions (for science) and defining problems (for engineering)		Use mathematics and computational thinking
	X	Developing and using models	X	Constructing explanations (for science) and designing solutions (for engineering)
	X	Planning and carrying out investigations	X	Engaging in argument from evidence
	X	Analyzing and interpreting data		Obtaining, evaluating, and communicating information
DIMENSION 2 Cross Cutting Concepts		Patterns		Energy and matter: Flows, cycles, and conservation
	X	Cause and effect: Mechanism and explanation		Structure and function
		Scale, proportion, and quantity		Stability and change
		Systems and system models		
DIMENSION 3 Core Concepts	Discipline		Core Idea Focus	
	Physical Sciences		PS1.B: Chemical Reactions	

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NGSS STANDARDS	Elementary School Standards Covered	
	2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot	

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Content Standards (K-12)			
	Systems, order, and organization		Evolution and equilibrium
X	Evidence, models, and explanation		Form and function
	Constancy, change, and measurement		
Physical Science Standards Elementary School			
X	Properties of objects and materials		

X Indicates standards covered in activity

prior to class

- You may want to cover work surfaces with newspaper to collect and absorb spills.
- Gather all materials.
- Make copies of student worksheets.
- Set-up hot plate in a safe area.
- Review basic information about how to use and read a thermometer and/or the WARD's Single Temperature Probe.

objective

Students will understand the effects of temperature on changes in matter caused by heating and cooling.

background

Matter is everywhere. Everything around you is matter which means it takes up space. Everything found on Earth can be grouped into one of three states of matter: solid, liquid, or gas. In order to figure out which state of matter an object fits in, we have to examine its properties. The properties we look at are shape, mass, and volume. Mass is the amount of matter an object has, and volume is the amount of space the matter takes up.

These activities help introduce the students to the concept that temperature causes matter to change from solid to liquid, and liquid to a solid. Students need to come to this activity with the knowledge that some solids turn into liquids and some liquids turn to solids when heated or cooled. They also need to understand the observable differences between a solid and a liquid.

build upon prior knowledge:

- Show students an ice cube, a glass of water, an uncooked egg, a cooked egg, a solid piece of butter and a melted piece of butter. Ask students to identify each object and classify it as a solid or liquid. List the student's responses.
- Focus attention on the water and ice. Ask students to describe how they are alike and different. *(Student response – they are both water, one is frozen, one is liquid.)*
- Repeat this process with the eggs and butter. Now ask what happened to the water that turned it into ice, the uncooked egg into the cooked egg, and the solid butter into the melted butter? *(Student responses may include – it was frozen, it was cooked or heated.)*
- Have students think about the ice. Ask students to identify the science tool they could use to determine the temperature of the water and the ice. *(Student response should be a thermometer.)*

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guiding questions

- ✦ What do you think will happen? (Hypothesis)
- ✦ What do you expect to learn?
- ✦ What tools are needed?
- ✦ How can we record our findings?

procedure - Day 1

1. Have students work in small groups to plan an investigation to help them understand the effects of heat on ice, an egg, and butter. Show students the containers with the ice, raw egg, and solid butter. Ask students how they can carry out their investigation to determine the temperature at which each substance changes. Students should record their plan on the worksheet. (ELA Literacy connection SL.K.3 - write a sentence as a group or individual)
2. Have students make and record predictions about the effects of heat on each substance (ice, egg, and butter). Predictions should include the temperature at which each substance will change and whether or not the change is reversible. (ELA Literacy connection SL.K.3 – write a sentence as a group or individual)
3. Data Collection – (Teacher led demonstration) before placing each container on the hot plate, take the temperature of the substances and record in a data chart. (Starting Temperature)
4. Heat the hot plate to about 300 °F. Place each substance on the hot plate, one-at-a-time. Observe as the substance changes. When the change is complete take the temperature of the substance and record in a data chart. (Heated Temperature)
5. Now cool all three substances by placing them in a freezer.

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procedure - Day 2

1. Review the information and data gathered from Day 1.
2. Remove the substances from the freezer, observe. Take the temperature of each substance and record in a data chart. (Cooled Temperature) Which changes were reversible? (*water can be refrozen, butter will solidify*) Have students check to see if their predictions were accurate.
3. Use the information in the data chart to create a graph. This can be done as a whole class or individual activity.
4. Interpret and analyze the data comparing it to student predictions. Ask students how the temperature affected each substance and whether or not the change is reversible.

summarize

Ask students what they have learned about the effect of heating and cooling the substances. (*Student responses may include – the heating of some substances changes them into liquids, while heating other substances changes them into solids. Cooling some liquids changes them to solids.*)

extension

Students can investigate the effects of heating and cooling on other common substances such as glass, wood, metals and plastics. Students can work in pairs or small groups to research the effects of heating and cooling on a substance using the internet. Each student group can share their findings with their classmates.



teacher notes

- ✦ Review basic information about how to use and read a thermometer.
- ✦ This activity uses the Ward's Single Probe to collect data allowing students to focus on the science discovery, leaving more time for learning and developing higher level thinking skills.

Worksheet - Heat It Up, Cool It Down

Name: _____

Investigation - Plan an investigation to explore the effects of heat on ice, an egg, and butter.

Write the steps you will follow to carry out the investigation to determine the temperature at which each substance changes.

Prediction – Predict the effects of heat on each substance.

Worksheet - Heat It Up, Cool It Down

Data collection

Substance	Starting Temperature	Observation	Heated Temperature	Observation	Cooled Temperature	Observation
Ice						
Egg						
Butter						

Graph

Substance Temperatures

