

Heavy Ice or Heavy Water?

Grade 5: Temperature Probe

Aligned with National Standards

overview

This is a teacher-led whole class inquiry activity where students observe the effects of temperature on mass. Students will learn about how regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

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 one session of 15-20 minutes.

materials required for the activity:

Ice
Scale
Temperature probe or thermometer
Container to hold the ice (and water)
Scrap piece of paper
Cup of water
Instructions (this guide) and student data table (page 7).

safety precautions

general safety:

- Consider establishing a safety contract that students and their parents must read and sign. This is a good opportunity 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.
- Remind students to read all instructions before starting the lab activities, and to ask questions about safety and safe laboratory procedures.
- Have students wash their hands after completing this and all lab activities.



WARD's in-house scientists are always on call to assist you with your questions. Our experts can provide personal solutions and product advice for your curriculum.

Email sciencehelp@vwr.com
or call 800-962-2660 to get started.

framework for K-12 science education © 2012

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		Engaging in argument from evidence
	X	Analyzing and interpreting data	X	Obtaining, evaluating, and communicating information
DIMENSION 2 Cross Cutting Concepts		Patterns	X	Energy and matter: Flows, cycles, and conservation
	X	Cause and effect: Mechanism and explanation		Structure and function
	X	Scale, proportion, and quantity		Stability and change
		Systems and system models		
DIMENSION 3 Core Concepts	Discipline		Core Idea Focus	
	Physical Sciences		PS3: Energy	

next generation science standards © 2013

NGSS STANDARDS	Elementary School Standards Covered	
	5-PS1-2-5. Structure and Properties of Matter - Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	

national science education standards © 1996

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

X Indicates standards covered in activity

prior to class

- You may want to cover work surfaces with newspaper to collect and absorb spills.
- Calibrate the scale(s).
- Have ice available.
- Have a piece of paper ready to rip and crumble as part of the introduction to the lesson along with a cup of water.
- Review basic information about how to use and read a thermometer and/or the WARD's Single Temperature Probe.

objective

Students will understand how temperature can change and mass will stay the same.

background

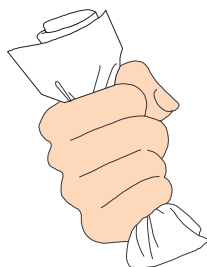
Matter is everything around you. Matter is anything made of atoms and molecules. Matter is anything that has mass and takes up space. In simple terms, mass is the amount of stuff in an object.

Matter can change from one physical state to another and not change its basic atomic parts. Water has the same atomic composition as ice. The liquid state is warmer and denser, but the molecules are still the same.

build upon prior knowledge:

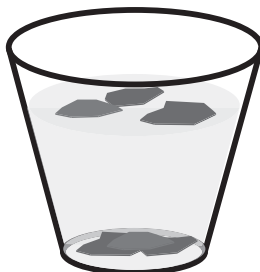
- Hold up a piece of paper and ask students what would happen to the mass of the paper if you crumpled it. See Figure 1. *(Student responses may include it will stay the same.)*

Figure 1: Crumpled paper



- Show the students a cup of water. Rip up the paper into small pieces. Ask the students if we know the mass of the paper and the water separately, what can we predict will happen to the mass of both if they are combined. *(Student responses may include that the paper will absorb water and be heavier. Overall, the mass of them separately should equal the mass of them combined, meaning the mass is constant.)*

Figure 2: Paper and water



- Show the students a glass of water with ice in it. If the ice were to melt would the drink have any less or more mass?

Figure 3: Ice water



(continued on next page)



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

1. Have students predict if the mass of ice will be more or less than the water created when the ice melts.
2. Take 1 cup of ice and weigh it on the scale.
3. Ask students to record the weight. *See data table on next page.*
4. Place the temperature probe inside of the container holding the ice and record the temperature.
5. Melt the ice by leaving the cup in a warm location.
6. Ask the students to weigh the container again when the ice is half liquid (use the temperature probe for data collection; at 10 °F the container weighed ...). You can also decide to take a temperature reading every 2 - 3 minutes.
7. Once the ice has completely changed to water, temperature and weight should be noted again.

summarize

Ask students to discuss what they have learned about the relationship between temperature and mass. (*Student responses may include: Temperature has no affect on the mass.*)

extension

As a more challenging experiment, have the students find the mass of something flammable like paper or tooth picks. Under adult supervision, burn the item and have the students find the mass again. This time the mass will be different but challenge them to determine what happen to the missing mass. (*Student answers may include: the smoke that was given off carried away some of the mass.*)

Another extension activity is to add a known mass of ice, and hot water and salt. Mix the ingredients together and record the temperature at different intervals. Find the mass at the end of the experiment of the combined solution and compare it to the individual parts.

Data Table

Physical State of the ice	Temperature (°F)	Mass (grams)
All Ice		
Half ice/half water		
All Water		



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.

