How Do Mittens Keep You Warm?

Do you have a favorite pair of mittens or gloves? Even if you do not live in a cold place, it is possible that you have been somewhere cold or will go to a cold place when you are older. When you wear mittens or gloves to keep you warm, where do you think the warmth comes from? In this experiment, you are going to find the source of the heat.

OBJECTIVES

In this activity, you will

- Find the temperature of the classroom and the temperature of your hand.
- Try to predict temperature changes that happen when the Go!Temp is placed in various locations.
- Test how warm mittens help your hands stay warm.

MATERIALS

computer with Logger Lite software installed
Go!Temp temperature probe
mitten

KEY QUESTION

Do mittens make heat or hold heat in?

HYPOTHESIS

Choose one of the following by checking the box in front of the statement that you think is right.

☐ 1. Mittens make their own heat.

☐ 2. Mittens hold heat in.

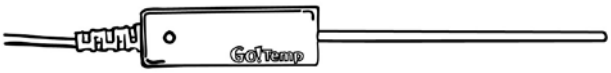
Why do you think so?

PROCEDURE

1. Make sure the Go!Temp is connected to the computer. Put the Go!Temp on the desk and don't touch it until you are told to do so later on.

2. Start Logger Lite on your computer.

3. Open the file for this activity by doing the following:



   a. Click the Open button, .

   b. Open the folder called "Elementary Science."

   c. Open the file called "02 Mittens."

4. Do the following to find the temperature of the classroom:

   a. Make sure the Go!Temp is lying on the desk and hasn't been touched by anyone. If it has been lying there for a few minutes, it will be the temperature of the room.

   b. Look at the digital meter on the screen and write down the temperature as the Room temperature in the Data Table, below.

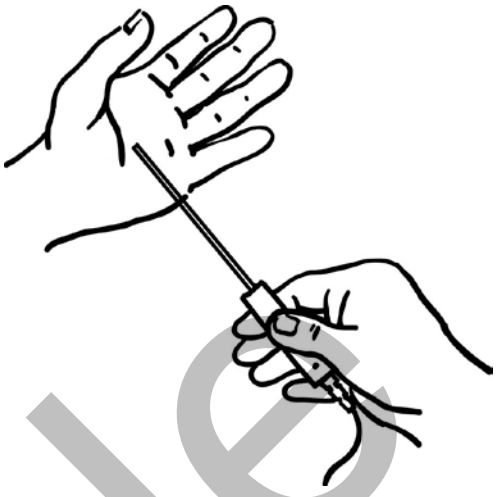
Data Table		**Room temperature _____ °C**	
	Prediction	**Temperature (maximum)**	**Was your prediction high or low?**
Open hand	**°C**	**°C**	
Empty mitten	**°C**	**°C**	
Open hand in mitten	**°C**	**°C**	

5. Make a prediction by following the steps below:

   a. Think about what will happen to the temperature on the screen if you hold the probe across the palm of your open hand during data collection. Think about your body temperature compared to the room temperature.

   b. Guess how high the temperature will be at the end of data collection and write down your prediction in the Data Table.

6. Now, collect data for the temperature of your open palm by doing the following:



   a. Make sure the temperature values in the digital meter on the screen are very close to the value you recorded as the room temperature in your Data Table in Step 4.

   b. Click Collect.

   c. Place the tip of the metal part of the probe in the middle of your open palm, holding it by the black end with your other hand.
   Important: The tip of the sensor should be gently touching your palm. Don't close your fingers over the metal part.

   d. Hold the probe in the correct position during data collection.

7. Do the following to find the maximum temperature of your open palm:

   a. Look through the data table on the screen.

   b. Find the maximum (largest) temperature value for the Latest data.

   c. Record this value in the correct place on the Data Table.

8. Click the Store button, , to store your data.

9. After you have finished finding the temperature of your open palm, place the Go!Temp on your table and allow it to sit there without being touched until you are told to pick it up again later on. This way, the probe will cool down to the temperature of the room.

10. Repeat Steps 5-9, but this time put the whole metal part of the probe inside a mitten lying on the table (do not touch the probe with your hand).

11. Repeat Steps 5-8, but this time put your hand in the mitten and touch the tip of the Go!Temp to the middle of your palm while data are being collected. The Go!Temp should look like the drawing at the right.

ANALYZE YOUR DATA

1. What is the source of heat in this experiment?

2. If the mitten does not produce heat on its own, then how do mittens keep your hands warm?

3. Thinking about the previous question, explain the difference between heat production and heat retention.

Good job!!

TEACHER INFORMATION

How Do Mittens Keep You Warm?

BACKGROUND INFORMATION

The goal of this activity is for students to discover that mittens are warm because they help hold in heat from the body and minimize its loss into the air. In other words, mittens act as insulators. Humans are warm-blooded animals. We typically maintain a body temperature of 37°C, or 98.6°F. On cold days, we lose some of our body heat to the air and our surroundings. This is because heat flows from materials with higher temperatures to materials with lower ones. One of the purposes of clothing is to hold in our body heat and minimize this heat loss. This is the reason we change the amount and kind of clothes we wear depending on weather.

The first several temperatures are taken to allow students to discover that (a) air temperature is usually less than body temperature, and (b) the temperature of the surface of a hand is typically below normal body temperature because heat is lost to the cooler surrounding air.

The final steps of the activity are done to show the insulating ability of the mitten. By itself, the empty mitten should have the same temperature as the air temperature. With your hand in the mitten, the temperature is higher because your hand is providing heat to warm the Temperature Probe. This temperature is also greater than the previously recorded temperature of the palm without the mitten. The mitten prevents the cold air from the outside from making contact with your hand; the mitten insulates your hand from the cold surroundings. Thus, our hands are warmer when we have mittens on.

Even if you live in a warm climate, you can do this activity. Many students will have been to colder places and can share their experiences with the rest of the class. You can also relate this activity to holding a cold drink or ice cream. Tell students that if they do go to a cold place in the future, they'll be able to help their family buy the things that they need by sharing the information they learn in this activity.

TIME FRAME FOR ACTIVITY

This activity takes about 45 minutes.

CURRICULAR CONNECTIONS

Language Arts – *The Mitten*, by Jan Brett, is a wonderful picture book to read. Discuss why the animals might want to snuggle in the mitten. A class discussion of the story and of appropriate clothing for different weather will lead students to a hypothesis of how

mittens keep hands warm. If you choose to read this book to your students, you may want to use the following introduction in addition to what is already in the student version of the activity:

Listen to your teacher read *The Mitten* by Jan Brett. Why do you think all the animals wanted to snuggle in Nicki's mitten?

Math – Comparisons, graph analysis.

HELPFUL HINTS

1. The student pages with complete instructions for data collection using Logger Lite or LabQuest App can be found on the CD that accompanies this book. See *Appendix A* for more information.

2. Data can be collected using a Go!Temp on a computer or a Temperature Probe on LabQuest. LabQuest does not support the use of Go! products.

3. This should probably not be the first temperature activity your students do. Begin with Activity 1.

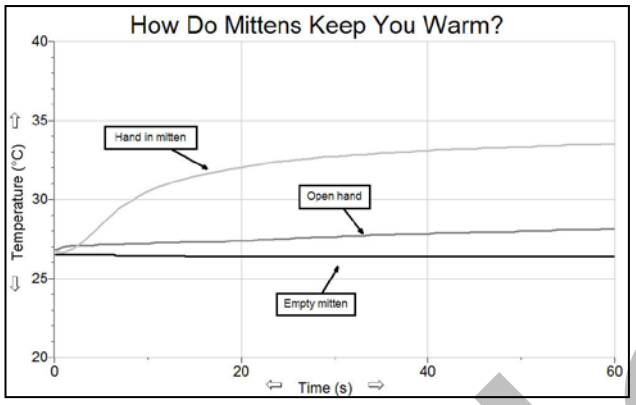
4. You can introduce the activity by reading the story, *The Mitten*, by Jan Brett. A discussion of the story and of appropriate clothing for different weather will lead the students to a prediction of how mittens keep hands warm.

5. Discuss the Key Questions as a large group. You can have students write their hypothesis and then share with the class.

6. If you do not have sufficient mittens, but you do have wool or synthetic, hiking-type socks, you may do the activity with those instead.

7. You may want to show your students how to highlight, copy, and paste their completed graph into their paper.

SAMPLE RESULTS



Sample graph of data collected during this activity

Data Table		Room temperature _____ °C	
	Prediction	**Temperature (maximum)**	**Was your prediction high or low?**
Open hand	**°C**	**28.1°C**	
Empty mitten	**°C**	**26.4°C**	
Open hand in mitten	**°C**	**33.5°C**	

ANSWERS TO THE ANALYZE YOUR DATA SECTION

1. The source of heat in this experiment is the student's hand, not the mitten.
2. Your hands produce the heat and the mittens keep the heat concentrated around your hands.
3. Answers will vary, but should include the facts that heat retention is the ability to keep the heat from leaving the mittens, and that without a source of heat the mittens will eventually cool to room temperature.

ASSESSMENT

1. Have students translate what they just learned by writing how heat is produced in their own homes, and what is used to retain this heat. Including how heat is repelled from their homes in the summer months would help them be able to follow the scope of this experiment.

EXTENSIONS

1. Students can bring in their own mittens or gloves to compare how well they insulate their hands.

2. Invite in a community member, such as a rescue worker, who can discuss how heat is lost in air and how heat is lost in water. Have students make a Venn diagram while they listen to the talk to compare and contrast heat retention and loss. Another idea for a speaker would be someone who works with a greenhouse to discuss what they do for heat production and heat retention.