

Thermometers

Laboratory Instructions

Science Action – 1st Grade

OUTLINE

It is best to have 2-3 parents at each stations, at least 2-3 extra parents working to replenish hot water thermoses and cleaning up spills and one parent walking around to demonstrate the Galileo thermometer between activities.

1. **Introduction.** Coordinator will lead entire class in a discussion of temperature and thermometers.
2. **Temperature/Thermometer Experiments.** Parents will lead small groups through 4 hands-on activities.
 - a. Temperature Trick.
 - b. Exploring Thermometers & Measuring and Recording Temperatures.
 - c. Predicting, Observing & Charting Temperature Changes.
 - d. **Mystery Bag Game.** Parents will lead small groups through a mystery bag game.
 - e. **Galileo Thermometer** have one parent prepare the Galileo Thermometer and jump into each table, between one of the four temperature experiments or the mystery bag game.

OBJECTIVES

1. Observe and discuss thermometers as tools that measure temperature.
2. Relate the numbers on the thermometer to hotter or colder temperatures.
3. Make the connection between higher temperature/faster moving molecules and lower temperatures/slower moving molecules
4. Practice measuring temperature with a thermometer.
5. Predict, observe, and measure temperature changes with a thermometer.
6. Perform a "temperature trick" to see how we can be fooled by our senses.
7. Practice charting temperature data.
8. Explore how people used to measure temperature with Galileo Thermometer

MATERIALS

Temperature/Thermometer Experiments:

- Laminated placemat (1/student)
- Cups (3 per student)
- Jug of "hot" water (about 104 °F — 1 jug per group of 5 students)
- Jug of "cool" water (about 76 °F — 1 jug per group of 5 students)

- Ice, in cooler (1-2 bag per classroom, 1 bowl or mini cooler per group of 5 students)
- Thermometers (1 per student)
- Student handouts for coloring recorded temperatures (1 per student)
- crayons (1 per student)
- several large sheets of paper for charting temperature an prepared with the graph
- Paper towels
- Garbage pail for waste water (2 per classroom)
- Food coloring
- Hairdryer
- Two clear glass cups
- Galileo thermometer
- Bucket of ice water to submerge the Galileo Thermometer in.
- Brown paper lunch bags (3 per small group - labeled A, B, and C with thermometers on the outside)
- Hot cocoa envelopes (1 per small group, placed in bag A)
- Granola Bars at room temperature (1 per small group, placed in bag B)
- Ice Cream Bar Boxes (1 per small group, placed in bag C)

While the leader is giving the introduction, have the parents go to their table and prepare for the first experiment.

INTRODUCTION (5 minutes)

Have ready: Thermometer presentation board and variety of thermometers.

Hold up a thermometer and ask: *Does anyone know what this is?*
(Accept all reasonable answers.) *That's right. It's a thermometer.*

What does a thermometer do?

(Accept all reasonable answers.)

It tells us the temperature or we can say that a thermometer is something that measures heat.

Where have you seen thermometers before?

(Accept all reasonable answers.)

How do we read a thermometer? (Show poster board).

What do you know about the numbers on the scale? What do you observe?

(Accept all reasonable answers.)

The only numbers that are written on the scale are the 10's. Let's practice by counting by 10's to 120. Each line between the 10's represents a number and we count those by either one's or two's depending on how many lines are in between the numbers.

When we read a thermometer, we read the number that is next to the top of the red line. Set the thermometer to 80°F and ask: What temperature is this? What's the weather like at this temperature? (Hot or cold?) Which set of pictures represents something you would be doing if it were 80°F outside? (Get them to pick out the summer pictures.)

The thermometers we will use today have two ways to read the temperature. You can read in Celsius or Fahrenheit. The "C" represents Celsius and the "F" represents Fahrenheit. In the United States we use Fahrenheit and in Europe, across the ocean and in some other countries they use Celsius. So today when you are reading your thermometer you will look at the numbers underneath the "F". If some kids ask why this is the case you might say that countries do things differently sometimes. For example Canada has different money than the U.S.

Ask, "Does anyone know why a thermometer rises when the temperature increases?"

Listen to answers and then say you will show the kids.

Have all the children come into the middle of the room and crowd into a tight group. Ask all the parent helpers to surround the kids holding hands, corralling the kids in the center of the circle. Have the kids stand very still with their hands at their sides. Tell the kids they are now no longer kids, but are molecules, tiny particles that make up water. Tell them that when water molecules are cold they are very stiff and packed close together. Ask them to be stiff or tight and stand close together. Then tell them that as the molecules warm up they begin to move around and they take up more room. Have the kids begin to gently jump around and when they do this have the parents move out, still holding hands, to give the kids more room. Now tell the molecules they are getting cold and that they have to stand still and pack in. The parents can move back in. Repeat this a few times. Have the kids sit down on the rug. Now bring out a thermometer and tell the kids the red liquid in the thermometer is like the kid molecules. As the red liquid warms up it needs more room to move around and it spreads up the tube. When the red liquid cools it packs tight together and can fit at the bottom of the tube.

Ask the teacher to direct the kids to the tables for the experiments.

A. TEMPERATURE TRICK (~8 minutes)

Prepare by giving each student:

- 1 placemat
- 1 cup filled half-full with warm water (place on "hot water" circle on placemat)
- 1 cup filled half-full with cool water + ice (place on "cold water" circle on placemat)
- 1 cup filled half-full with cool water (place on "mixed water" space on placemat)

Note: Have paper towels on hand in case of spills.

Group Leader:

We are going to see if we can tell what the temperature of the mixed water is without using a thermometer. Ask students to push up their sleeves.

- 1. Dip your fingers carefully into each cup of water so that you can feel the temperature of each cup. Ask students how each cups feels. Does each cup feel warm or cold? If the cup is labeled warm does it feel warm? If the cup is cold does it feel cold?*

Now let me see if I can trick you.

- 2. Put one hand in the hot water and the other hand in the cold water for about a minute.*
- 3. We are going to do one hand at a time. Put your hand that is in the cold water in the mixed water. Does the water feel warm or cold? Accept answers. It should feel warm.*
- 4. Put that hand back in the cold water. Now take your hand from the hot water and put it in the mixed water. Does the water feel warm or cold? Accept answers. It should feel cold.*

Discussion:

How can the mixed water feel both hot and cold at the same time? Is it two different temperatures? Accept answers.

The mixed water is not two temperatures. It's just one temperature, but it feels different to each hand. That happens every time. Our sense of temperature depends on where our body has been. We do our best, but we're not always accurate about sensing temperature. Sometimes, just like here, the temperature fools us. That's why thermometers were invented. Once you have a thermometer, you don't have to touch things to see how warm or cold they are. You have a scientific tool to tell you the true temperature.

B. EXPLORING THERMOMETERS & MEASURING AND RECORDING TEMPERATURES (~10 minutes)

Prepare by:

- Keep using the placemats
- Replenish the "warm" cup with warm water (if necessary)
- Empty the cold water cup and fill it with ice chips and a little water
- Empty the "mixed" cup
- Get thermometers ready but do not hand out yet (1 per student)
- Give out the student handout for coloring recorded temperatures (1 per student)
- Crayon (1 per student)
- 2 glass cups, one filled with hot water and one filled with very cold water (1 set per table)
- Dropper of food coloring (1 per table)

Group Leader:

Hold up one of the thermometers and talk again about how there are Fahrenheit and Celsius temperature gauges on the thermometer. Point out that we will be reading the Fahrenheit. Look at the markings and how the thermometer is read. Now, pass out thermometers and let children become familiar with them. Ask them to read the temperature on their thermometer and go around to make sure they are correct. Help them if they need assistance. Point out that the temperature they all read is the temperature of the room right now. Ask them to put their thermometers down.

Now do the food color demonstration:

Have all the kids watch the glass cups. Show them that one is filled with hot water (should be pretty hot to make the point) and one is filled with ice cold water. You may want the kids to touch the outside of the glass so they believe you.

Place a drop of food coloring in the warm and cold water. Point out that the food coloring stays in a tight ball in the cold water because the water molecules in cold water do not have much energy and cannot move very fast. The molecules in the hot water have lots of energy and can move around really fast and spread apart.

This is the same with the liquid in a thermometer. When the thermometer is placed in hot water the molecules move around a lot and spread out making the red thermometer liquid move up higher. When the thermometer is in cold water the red thermometer liquid does not have much energy and stays crowded together and does not move up.

Remove and dump the food coloring water.

Ask: What do you think will happen if you stick your thermometer in the hot water?

[The red liquid in the thermometer will expand (get bigger) and since it has no where else to go, it will go up the tiny tube.] Have them place the thermometer in the warm water and record the temperature on the sheet using the crayon to fill in the thermometer tube to match the temperature and then write the temperature on the paper below the thermometer.

Ask: What do you think will happen if you stick your thermometer in the ice cold water? [The red liquid in the thermometer will contract (get smaller) and will go down.] Put the thermometer in the ice cold water and let it sit there until the red liquid in the thermometer stops moving. Then read the temperature and record it on your paper. Help those who need help reading and recording the temperature.

Have the kids make a mixture of the hot and cold water in the empty cup. Measure this temperature and record the temperature on the sheet using the red crayon to fill in the

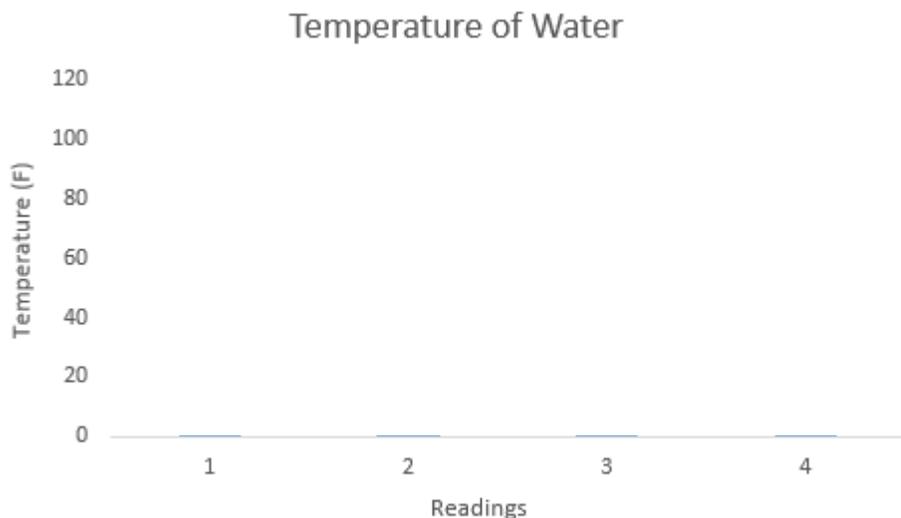
thermometer tube to match the temperature and then write the temperature on the paper below the thermometer picture.

C. PREDICTING, OBSERVING, & CHARTING TEMPERATURE CHANGES

(~10 minutes)

Prepare by:

- Keep using the placemat
- Replenishing the "warm" cup with warm water (if necessary)
- Empty the "cold" cup completely and add ice chips to the cold cup, no water.
- Empty the "mixed" cup
- Tape a large sheet of paper near the table. On the paper draw the graph below. On the x-axis should be "readings" numbered from 1-4, and on the y-axis should be the temperature ranging from 0 to 120 degrees. See below



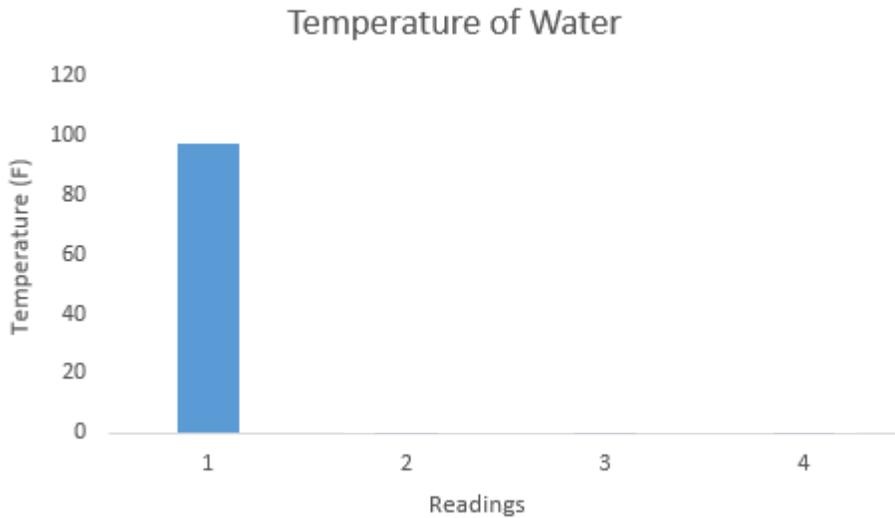
Group Leader:

Show the kids the blank graph. Tell them that a graph is a way to show information quickly and that we will make a graph of how water temperature changes as we add ice to the water. Show them that you will be making four readings and that the temperature for each reading will be as high as the temperature on the left side of the graph.

Ask: What do you predict will happen if you put your thermometer into the empty cup, then pour hot water into the cup? Have students make predictions. Why? [The temperature should increase because the temperature of the hot water is higher than the temperature of the air.]

Ask students to put their thermometer into the empty cup and then pour on the "warm water" into the empty cup. Wait until the temperature stops changing. Have them read the temperature. Survey all of the kids, and in your head, calculate an approximate average

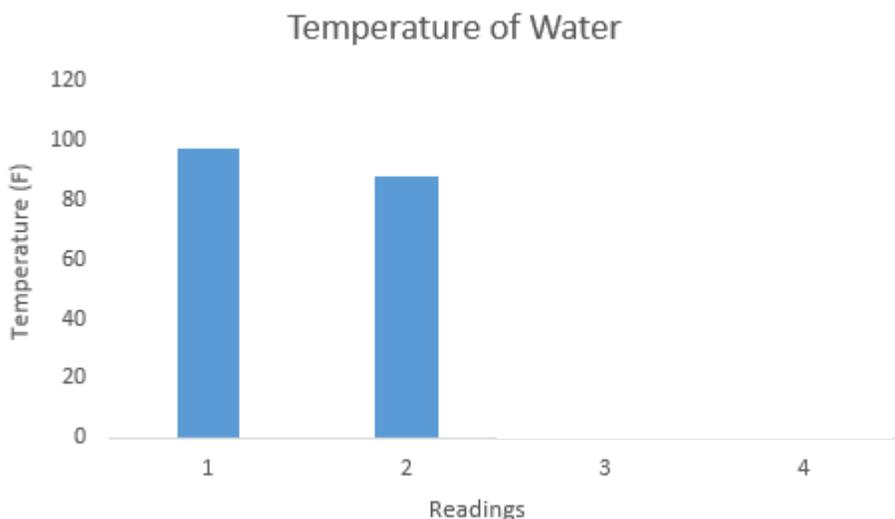
temperature. Say, "the temperature was around X degrees and then make a bar on your graph at temperature reading X. it might look like this:



Ask: *What do you think will happen if we add 5 pieces of ice to our hot water?* Have students make predictions.

Add 5 pieces of ice to your cup of hot water. Make sure you are carefully watching the thermometer reading as you add the ice. They may need to stir the ice in the cup (using the thermometer) to see a noticeable temperature change.

Wait until the temperature stops changing. Have them read the temperature. Survey all of the kids, and in your head, calculate an approximate average temperature. Say, "the temperature was around X degrees and then make a bar on your graph at temperature reading X. it might look like this:



Ask: *What do you think will happen if we add 5 more pieces of ice to the hot water?* Have students make predictions.

Wait until the temperature stops changing. Have them read the temperature. Survey all of the kids and in your head calculate an approximate average temperature. Say, "the temperature was around X degrees and then make a bar on your graph at temperature reading X. You may want to ask one of the kids to add the bar now that they see what you are doing on the graph.

Now for your fourth reading, add 5 more pieces of ice to the cup of water. Again, have them read the temperature. Survey all of the kids, and in your head calculate, an approximate average temperature. Say, "the temperature was around X degrees and then make a bar on your graph at temperature reading X. You may want to ask one of the kids to add the bar.

Admire your graph. Describe how it shows the water temperature decreasing. Does it flatten out at the last readings? Does the temperature not decrease as fast as the first two readings?

D. MYSTERY BAG GAME (~8 minutes)

Materials:

- Three mystery bags/table handled by parent (do not give each kid a mystery bag)
- Mystery Bag Game "Clue" sheets (1 per student)

Group Leader:

Prepare by: Each table should have only three bags. You should not give each student three bags. Do not let the kids hold the bags. These items are really, really old. Do not let them out of your sight, or you may have one kid eating some of the mystery bag items (Yes! This did happen.)

Explain to your small group that you have a mystery for them to solve. *Tell them a granola bar is in one bag, an ice cream treat is in another bag and the third bag has hot chocolate. Using the temperature readings on the bags, let us see if we can figure out what is in each bag.*

Hold up one bag and ask them to figure out the temperature on the bag. *Depending on what they say, ask them would you find a granola bar, hot chocolate or ice cream in this bag.* If they guess correct open the bag and pull out the item.

Now hold up the second bag and read the temperature. Have them guess what might be in this bag. Finish by revealing what is in the final bag and verifying with the temperature. You can pack everything up by playing the game in reverse. Lay the bags on the table. Hold up one of the items and ask which bag it belongs in. Follow with the other items until everything is put away.

E. GALILEO THERMOMETER

Materials:

- Galileo thermometer
- Bucket of ice cold water
- hairdryer

This part of the lab should be run by one parent who goes around to the tables to demonstrate this special thermometer.

Look at the Galileo thermometer and describe how to read the thermometer by looking at the lowest floating temperature ball. Have all of the kids place their hands on the Galileo thermometer to try and warm it up. See if the temperature changes. Use a hairdryer to warm up the Galileo thermometer and see if you can get the bulbs to shift. Now, place the Galileo thermometer into a bucket of ice water and watch how the bubbles change.