



Creating a Thermometer

Grade Level	Second	Subject	Science
Objective(s): Students will understand how a thermometer is used and read. Students will construct a thermometer to see how temperature changes. Students will understand that temperature rises when it is warm and falls when it is cool.		SOL Addressed: 2.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which <ul style="list-style-type: none"> a) Observations and predictions are made and questions are formed; e) length, volume, mass, and temperature are measured in metric units and standard English units using the proper tools; k) observations and data are communicated l) simple physical models are designed and constructed to clarify explanations and show relationships. 	
		Next Generation Standards: K-2-ETSI-3: Analyze data from tests of 2 objects designed to solve some problem to compare the strengths and weaknesses of how each performs.	
Materials Needed Per Class of 30 and Prior Knowledge	2 packs of thermometers (12 in each pack) 24 12oz. clear water bottles (12 for each class) Water (1/4 cup for each pair) Rubbing alcohol (1/4 cup for each pair) 12 measuring cups 15 clear drinking straws Playdough Red food coloring 12 small funnels Gallon sized Ziploc bags Ice 15 Safety Goggles Black marker/sharpie ActivBoard Ceed Dashboard Link: http://dashboard.intellergy.us/ceed/ WeatherBug Link: ceed.frco.k12.va.us (Click on the Weather Station) We have been discussing weather related terms such as weather, temperature, thermometer, and meteorologist.		

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<p style="text-align: center;">Ways to differentiate this lesson plan</p>	<ul style="list-style-type: none"> • EXTENSION for Higher Level Learner: Students will watch the local weather forecast for 5 days and make a graph of the temperatures recorded. They will compare the highest and lowest temperatures by finding the difference. • Students will also design their own scale on the thermometers they created. (Students will be given materials if they want to create their own thermometer to take home to complete this part of the activity). <p>MODIFICATIONS: If students are having trouble putting their thermometers together, I will guide them through it.</p>	
<p style="text-align: center;">Introduction/ Anticipatory Set</p>	<p>Anticipatory Set: Today we are going to learn about why temperature is important and how a thermometer works. You will also work with a partner to create a thermometer.</p> <p>Questions to ask students:</p> <ul style="list-style-type: none"> • How does a thermometer work to measure temperature? • What do you think makes the red line move up or down in a thermometer? • How are the numbers on the thermometer related to the red line in the thermometer? • Why do we need to record temperature? • How does the temperature help us in our daily lives? • What do meteorologists do with temperatures recorded? 	<p>Introduction:</p> <p>After asking questions, let students answer. Use the ActivBoard to make a list of responses. Give each student a real thermometer. Tell them that temperature is measured on a scale. Those scales are Fahrenheit and Celsius. Fahrenheit is used by the United States and Celsius is used by scientists and other countries. Explain that thermometers count by 10's and point out smaller marks between the numbers. Also point out in between each number is halfway between the numbers. There is a liquid in the thermometer called mercury (probably alcohol in student thermometers) that rises and falls. Ask them to take a minute to place the thermometer somewhere in the room to record temperature. After they get a temperature, they will come back to the carpet.</p>

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<p>Guided Practice</p>	<p>Students will discuss the temperatures they took with the store bought thermometer. Show students a homemade thermometer. Point out the materials used to make the thermometer and that the straw is not touching the bottom of the bottle. They will determine how to put the materials together to make a thermometer. (There will be note cards with the amount of water, alcohol, and red food coloring that goes in the thermometer).</p> <p>Sample Facilitator Questions for the Activity?</p> <p>How do you suppose the mixture will move when you place your hands around the bottle? What will happen to the mixture when the thermometer is placed in a bag of ice?</p>
<p>Independent Practice</p>	<ol style="list-style-type: none"> 1. Students will work with a partner to decide how to use the given materials to build their thermometer. (Those materials are placed in a tray at their desks). 2. After putting the thermometer together, they will place their hands around the bottle to see what happens to the mixture. 3. Next, they will place their thermometer in a bag of ice and watch what happens to the mixture. 4. We will go outside with the created and store bought thermometers. They will observe the temperature rise or fall on the store bought thermometer. Students will also test their thermometers to see if the liquid rises or falls because of the temperature.
<p>Closure (Summary of Lesson)</p>	<p>After creating the thermometers and testing the movement of the mixture in the thermometers, the students will share their results with the class.</p> <p>Questions to ask: Did something hot or cold make the thermometer rise? Where else could we test the thermometers?</p> <p>Show the Ceed Dashboard on the ActivBoard. Point out that the dashboard displays a thermometer and a graph for the lowest and highest temperatures for a month. Ask if the temperature is similar to the temperature they recorded.</p> <p>Next, go to the Weather Station on the ceed website. Point out the following information on the WeatherBug: temperature, wind, precipitation, maps, and the camera. Specifically discuss the 10 day forecast that is also provided on the site.</p>
<p>CEED Building Application/ Sensor Data</p>	<p>The CEED Dashboard will be used to display the temperature. The CEED website will be used to display the weatherbug station and what is represented on it.</p>

Assessment	Teacher observation, Student participation, Thermometer models
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INQUIRY LEARNING RESEARCH PROCESS GUIDELINES

The following table is just one guideline to use for developing your own inquiry materials. The seven steps in the Learning Research Process include not only how people learn but also how research is conducted. The heart of the design, the three-stage learning cycle of exploration, concept invention or formation, and application is embedded in the middle. In addition to these three stages, this design takes into account that learners need to be motivated to spend the time required for understanding complex subjects and that learners need to build this new knowledge onto prior knowledge. These are similar to the 5E and 7E learning models.

The Learning-Research Process

Steps in the Learning-Research Process	7E Equivalent	Component of the Activity
1. Identify a need to learn.	Engage	An issue that excites and interests is presented. An answer to the question <i>Why?</i> is given. Learning objectives and success criteria are defined.
2. Connect to prior understandings.	Elicit	A question or issue is raised, and student explanations or predictions are sought. Prerequisite material and understanding is identified.
3. Explore	Explore	A model or task is provided, and resource material is identified. Students explore the model or task in response to critical-thinking questions.
4. Concept invention, introduction, and formation	Explain	Critical-thinking questions lead to the identification of concepts, and understanding is developed.
5. Practice applying knowledge.		Skill exercises involved straightforward application of the knowledge.
6. Apply knowledge in	Elaborate and Extend	Problems and extended problems require synthesis

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new contexts.		and transference of concepts.
7. Reflect on the process	Evaluate	Problem solutions and answers to questions are validated and integrated with concepts. Learning and performance are assess

Hanson, D. (2006). POGIL Instructor’s Guide to Process-Oriented Guided-Inquiry Learning. Lisle, IL: Pacific Crest