

Insulation Investigation (with Indigenous ways of Knowing)		Grade 5 Matter and Energy	
Lesson Plan	Coding Tool	Micro:bit	
	Cross-curricular	STEM Skills and Connections	
<p>Big Ideas</p> <ul style="list-style-type: none"> • Heat is a form of energy that can be transferred between objects and environments. • Different materials slow down or speed up heat transfer in different ways. • Changes in temperature can cause matter, such as water, to change state without becoming a new substance. • Indigenous communities developed effective insulation technologies by carefully observing their environments over time. • Scientific understanding can come from both Indigenous ways of knowing and modern scientific tools. 	<p>Specific Expectations</p> <ul style="list-style-type: none"> • C2.3 describe changes of state of matter observed at home, in the community, or in the natural environment • C2.4 describe physical changes in matter as changes of the state, volume, or form of the matter that do not result in the formation of a different substance 		
<p>Description</p> <p>This lesson invites students to explore heat, insulation, and changes of state through both scientific investigation and Indigenous ways of knowing. Students learn how temperature affects matter. Through hands-on experimentation, students use micro:bits as temperature sensors to measure how well different materials retain heat. These materials reflect both natural and manufactured insulators, allowing students to compare their effectiveness.</p> <p>This lesson plan also highlights how some Indigenous communities such as Inuit and Anishnaabe peoples used observation and knowledge of natural materials to design clothing and shelters that protected them from winter temperatures long before modern technology.</p>			

<p>Materials</p> <ul style="list-style-type: none"> • Micro:bit (can be V1 or V2) <p>A lot of insulation materials:</p> <ul style="list-style-type: none"> • Synthetic cotton • Wool • Natural bark • Feathers • Cedar boughs <p>Note: You do not need these exact materials, these are ideas.</p> <ul style="list-style-type: none"> • Bag(s) of ice for testing of insulating materials <p>Note: if it is winter, the insulation testing can happen outside.</p>	<p>Computational Thinking Skills</p> <ul style="list-style-type: none"> • Data collection • Sequencing • Variables • Data representation • Debugging
<p>Introduction</p> <p>Many Indigenous communities live in regions where winter temperatures drop very low. Long before modern technology such as battery-heated jackets and gloves, insulated snow pants, waterproof winter boots, fleecelined hats, and thermal mittens, Indigenous peoples found everything they needed to stay warm by living off the land, meaning they used natural materials from animals, plants, and the environment to meet their needs. In northern climates, winter becomes so cold that lakes and rivers freeze, snow piles up, breath turns to mist, and even boiling water can instantly turn to ice crystals if thrown into the air. These are all examples of matter changing state; water turning from a liquid to a solid when the temperature drops below freezing.</p> <p>To survive these extreme temperatures, Indigenous communities needed materials that provided insulation, which means a material that slows down the transfer of heat, helping keep warmth inside clothing, homes, or shelters. Effective insulation helped prevent their food and drinking water from freezing and protected their skin from frostbite. Frostbite happens when body tissues freeze a change of state where water in the skin turns to ice, but the substance itself (water) does not become something new. It simply changes from liquid to solid.</p>	

Different Indigenous communities developed highly effective winter technologies using local resources.

- Inuit peoples used materials like caribou hide and seal pelts to make warm, windproof clothing. Caribou fur is especially insulating because each hair is hollow and traps warm air. They also used tightly packed snow to build igloos, snow contains tiny air pockets that make it an excellent insulator.
- Anishinaabe peoples used deer, moose, and beaver hides for clothing, providing warmth and water resistance. For their homes, they used birch bark, which is strong and repels water, and cedar, which resists rot and provides natural insulation.

These traditional technologies show deep scientific knowledge developed over thousands of years, about materials, temperature, and energy transfer. The solutions created by Indigenous peoples were not only effective but sustainable, respectful to the land, and perfectly adapted to the winter environments they lived in.

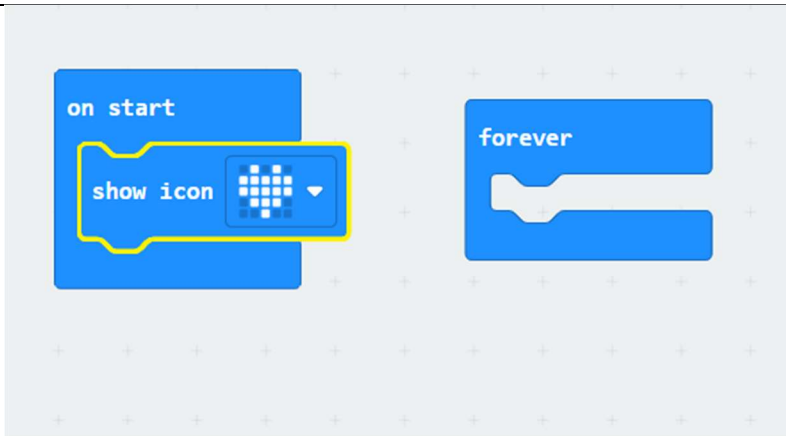
Action

Insulation investigation with micro:bit.

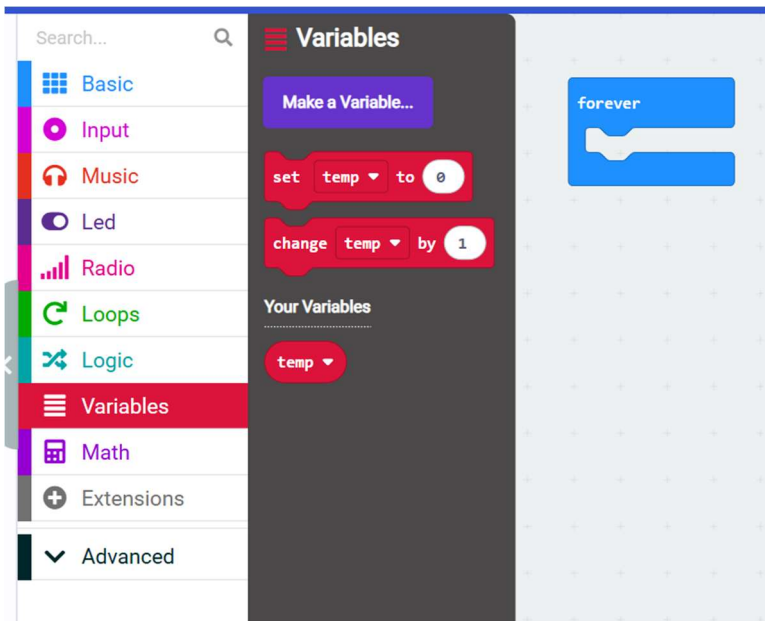
1. Go to <https://makecode.microbit.org/>
2. Plug Micro:bit into computer.
3. Refer to coding below.

Coding microbit to react to temperature levels.

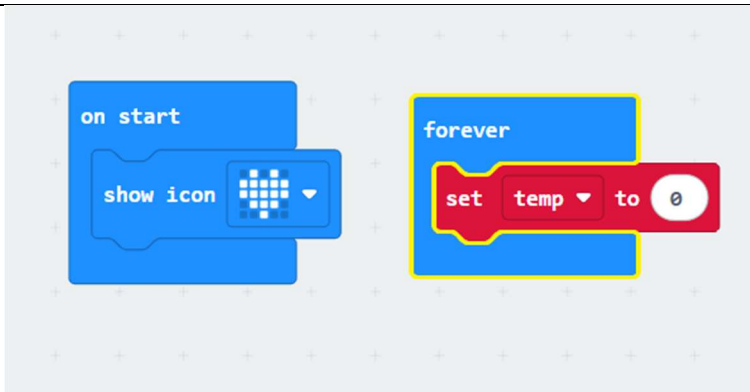
1. Connect the first Microbit via the USB and go to makecode.microbit.org to start a new program. Before starting to code the program, pair the Microbit by clicking on the gear symbol and selecting Pair -> Pair Device -> Select Microbit -> Connect
2. In the **Basic** tab, you will grab and drag the “show icon” block into the “on start” block. This will be to show that the microbit is working.



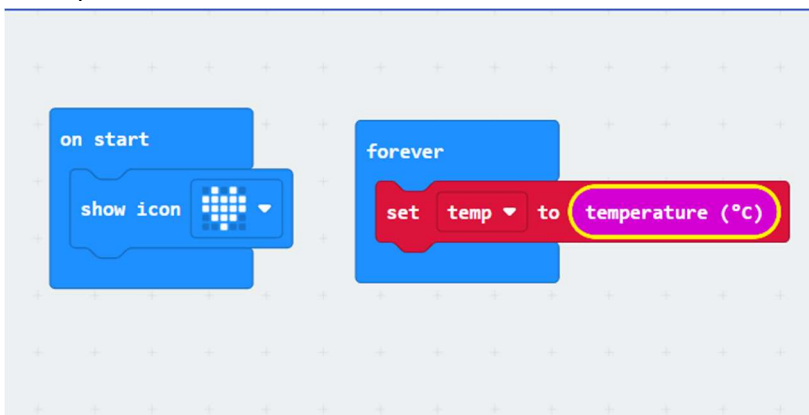
3. In the **Variables** tab, you will create a variable and call it “temp”. This is going to be a place holder.



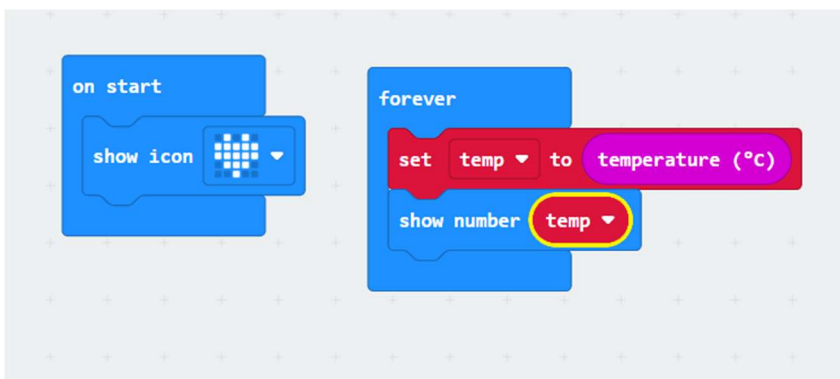
4. In the same **Variables** tab, you will select and drag the “set temp to 0” in the “forever” block.



5. In the **Input** tab you will select and drag the “temperature (C)” bubble and place it in the “0” slot.

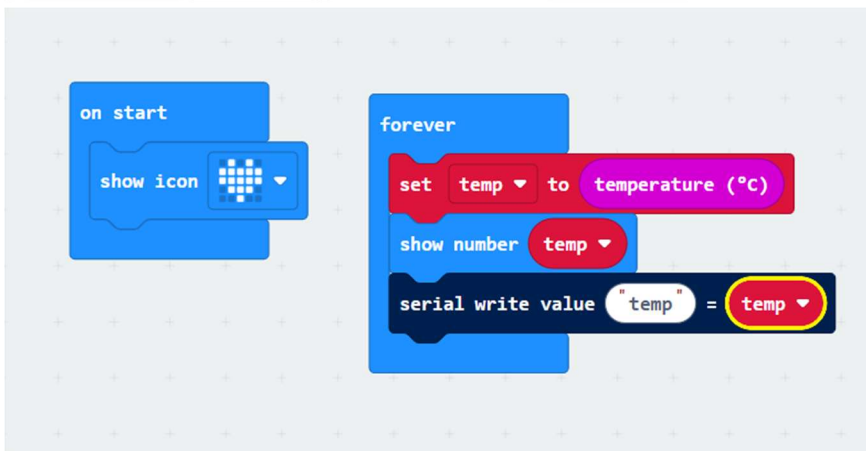
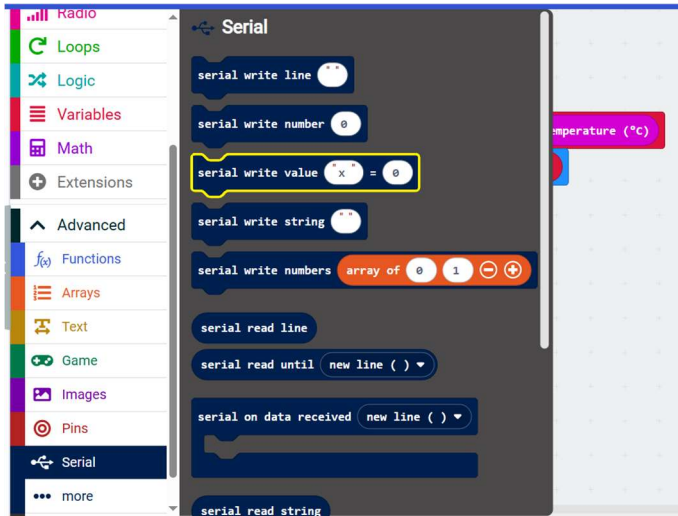


6. In the **Basic** tab you will select and drag the “show number 0” block and place it under the “set temp to temperature” block in the forever loop. Then in the **Variables** tab, select and drag the “temp” bubble into the 0 slot.

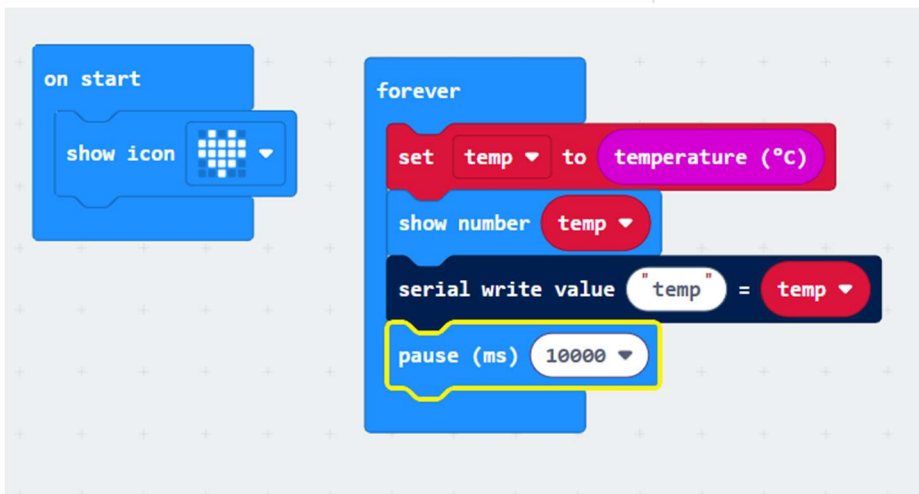
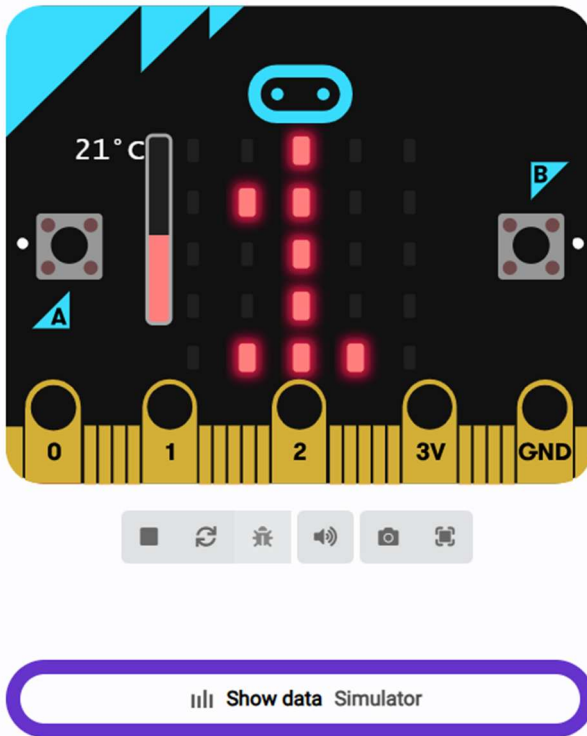


7. Click the **Advanced** tab, that will bring you to a drop-down section. There, you will select the **Serial** tab and then select and drag the “serial write value ‘x’=0” block and place that underneath the “show

number “temp” block. In the “x” you are going to type in “temp.” And in the “0” slot you will select your “temp” variable bubble and place in there.

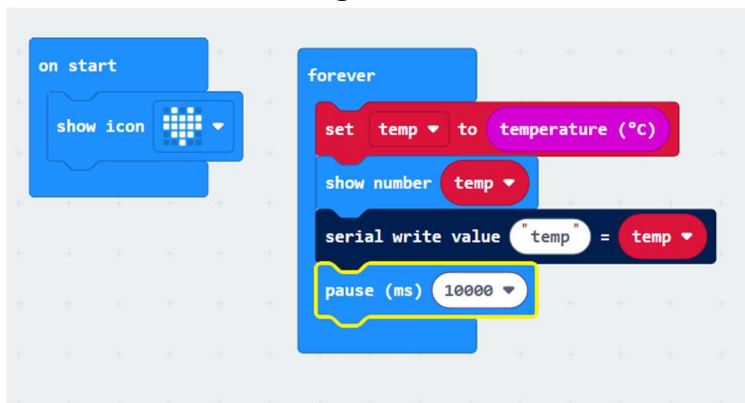


- This step will give you a graph. Under the microbit icon a bar will show up that reads “show data simulator”. When clicked you can read view your temperature data on the graph



8. In the Basic tab you will select and drag the “pause (ms) 100” block and place under the “serial write value ‘temp’=temp”. Then change

the 100 to 10000. To give students 10 seconds in between readings.



9. Hit “download” to send the code to the microbit and then you can test the code! You can then attach the battery pack to the microbit so you can unplug it from your computer.

Consolidation/Extension

After the investigation, students compare their temperature graphs and discuss:

- Which materials kept the temperature most stable?
- Which materials allowed heat to escape or enter the fastest?

Students complete a short reflection or discussion about how does understanding heat and insulation helps us understand why certain materials were traditionally used for clothing and shelters?

Extension

- Students redesign their experiment by layering materials and predicting whether insulation improves
- Students compare natural vs synthetic materials and discuss environmental impact
- Students modify their code to include icons or alerts for “cold” or “warm” temperatures.

Assessment

Students demonstrate learning by:

- Interpreting their temperature graphs and explain patterns
- Reflecting on how Indigenous knowledge connects to scientific ideas
- Correctly coding a Micro:bit to collect temperature data
- Accurately describing how insulation affects heat transfer
- Making a clear connection between scientific findings and Indigenous winter technologies.