Salinity Testing with Micro:bit	Gr. 7/8 Life Systems

Lesson Plan

Coding Tool	Micro:bit
Cross-curricular	- STEM Skills and Connections

Big Ideas

- Water is a vital resource that sustains all life and must be respected and protected.
- Human activities, such as the use of road salt, can negatively impact water systems and ecosystems.
- Technology and coding can be used to test and monitor water quality.
- Indigenous knowledge and perspectives provide important guidance for caring for water and the environment.

Specific Expectations

Grade 7/8

- **A2.2** identify and describe impacts of coding and of emerging technologies, such as artificial intelligence systems, on everyday life, including skilled trades
- **A3.2** investigate how science and technology can be used with other subject areas to address real-world problems

Grade 7

- **B1.2** assess the effectiveness of various ways of mitigating the negative and enhancing the positive impact of human activities on the environment
- **B1.3** analyse how diverse First Nations, Métis, and Inuit practices and perspectives contribute to environmental sustainability

Grade 8

- **E1.2** demonstrate an understanding of First Nations, Métis, and Inuit knowledges and values about water, connections to water, and ways of managing water resources sustainably

Description

This lesson explores the importance of water through both Indigenous ways of knowing and scientific investigation. By coding Micro:bits to test water quality indicators such as salinity. Students will evaluate solutions for protecting water and enhancing environmental sustainability.

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Materials	Computational Thinking Skills
- Micro:bit - 2 alligator clips - 2 nails (or other conductive materials like paperclips, metal screws, etc.) - Distilled water - Salt water - Jars - Battery packs for the Micro:bit - Computer	- Conditional statements - Inputs and outputs - Sensors - Variables

Introduction

In many Indigenous communities, Waterkeepers uphold the sacred connection to water, advocating for its protection and proper care. Students will reflect on these teachings while investigating water quality.

Water is the first medicine. It connects all living things and sustains life. For the Anishinaabe, water is understood as a living entity. “Niibi” (water) deserves respect and protection. We come from water, water flows through us, we are water, and our relationship with it is both physical and spiritual.

As water sources face increasing pressures from human activities such as pollution, overuse, and climate change. Understanding how to monitor and protect water becomes essential. In this lesson, students will assess the impact of human actions on water systems and explore how traditional knowledge, and modern technologies can work together to solve real-world problems.

Salinity:

Salinity is the amount of dissolved salts in water. This includes not just table salt (sodium chloride), but also other types of salts like calcium, magnesium, and potassium. Salinity can come from natural sources, like minerals in rocks, or from human activities such as road salt, farming, and wastewater.
When there’s too much salt in water or soil, it can cause problems for the environment, farming, and even buildings and roads. High salinity can make it harder for plants to grow because salt makes it difficult for roots to take in

water. It can also damage crops, lower food production, and harm freshwater animals that aren't used to salty conditions. In addition, salt can corrode metal and concrete, leading to damage in things like bridges, pipes, and fences.
Managing salinity is important for protecting ecosystems, supporting healthy agriculture, and avoiding damage to infrastructure.

Human impacts on water:
During the winter months, salt, typically sodium chloride, is commonly applied to roads to melt ice and improve driving safety. While this practice enhances public safety, the salt does not remain on road surfaces. Instead, it is carried away by melting snow and rain, creating saline runoff that often enters nearby storm drains, rivers, lakes, and surrounding soil.
When significant amounts of road salt reach freshwater systems, they increase the salinity of the environment. Many aquatic species, such as fish, amphibians, and aquatic insects, are adapted to thrive in low-salinity conditions. Elevated salt levels can stress or harm these organisms, leading to disruptions in the aquatic ecosystem. In addition, salt can seep into groundwater supplies, which some communities depend on for drinking water, and contribute to the corrosion of infrastructure such as pipes, bridges, and roadside equipment. Vegetation near roadways may also be damaged due to prolonged salt exposure.

Water testing is important because it ensures your water is safe to drink.

Action

Testing salinity with a microbit.

To test salinity using a Micro:bit, nails, and alligator clips, you'll need to create a simple circuit that measures electrical conductivity, which is affected by salinity. Higher salinity results in higher conductivity. You'll connect the Micro:bit to two nails acting as probes using alligator clips, and then code the Micro:bit to read the conductivity of the solution.

Pre prepare the water samples before hand. 1 distilled, 1 extremely salted water.

1. Go to https://makecode.microbit.org/

2. Prepare the Micro:bit
   - Probes: Attach two nails securely to the ends of two alligator clips.
   - Connections: Connect one alligator clip to Micro:bit pin 0 and the other to the 3V pin

3. Plug Micro:bit into computer

4. Prepare water samples

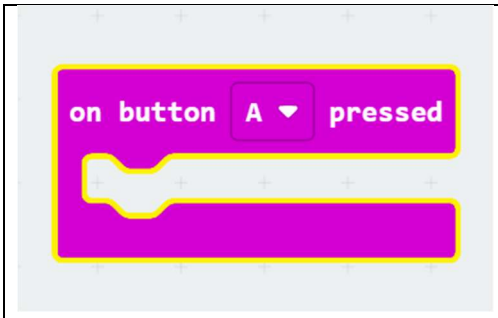
5. Refer to coding below

To test the sensors created by the students, provide them with one of each of the samples, unlabelled. They can then use the different tests to determine which sample is which. The results should be as followed:
• Distilled water: lowest turbidity, lowest conductivity
• Salt water: high turbidity, high conductivity

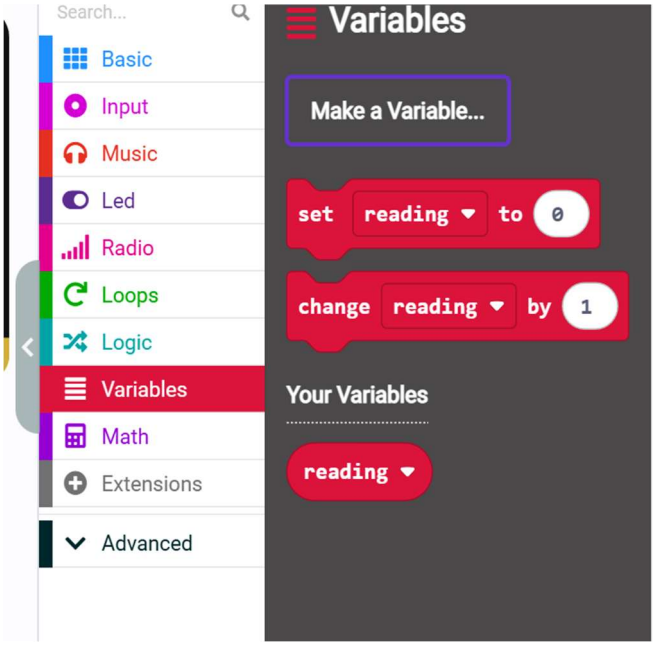
Coding to receive "salinity" number.

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

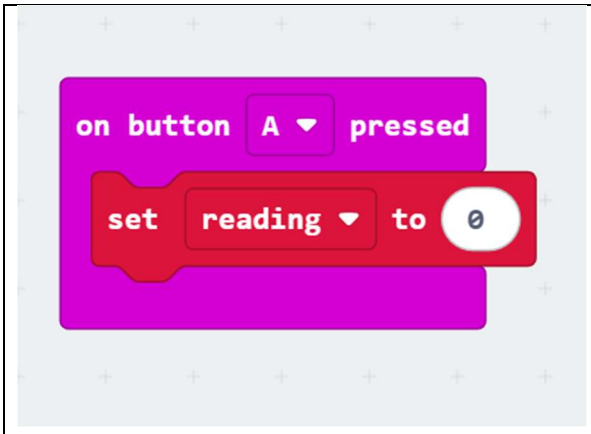
2. Students will **not** need the "forever" or "on start" blocks, you can delete them.
   - Go to the **input** tab -> click and drag "On button A pressed"



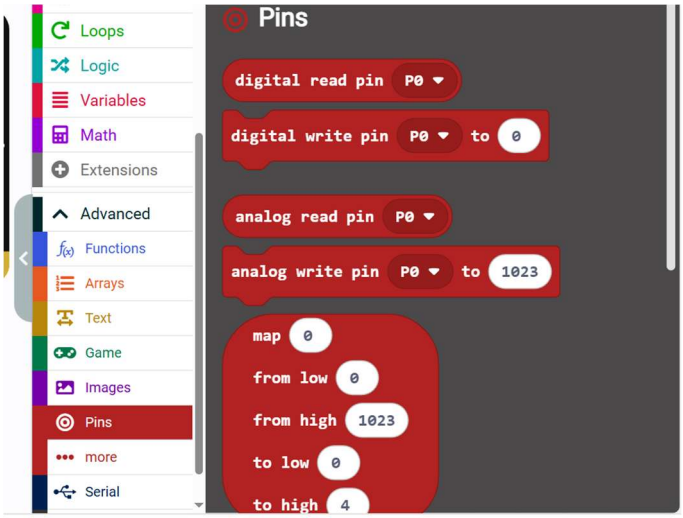
3. Next we will have to make a variable, in the **Variables** tab, click, “Make a Variable” and name it “reading” or “read”.



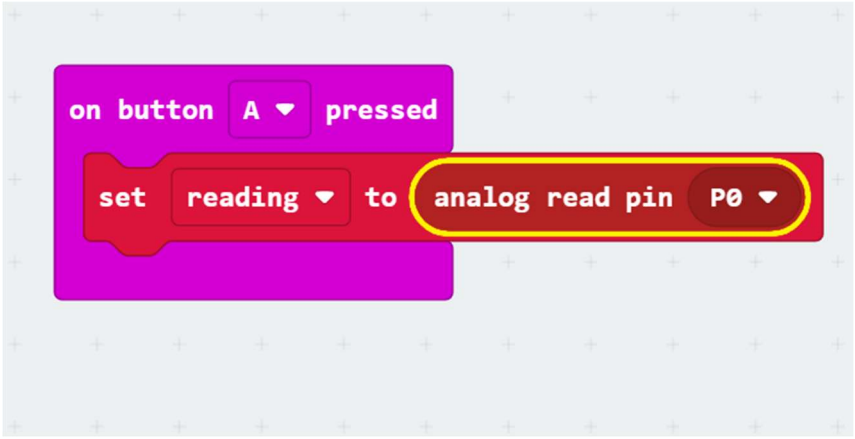
4. In the **Variable** tab, select and drag “set ‘reading’ to 0”



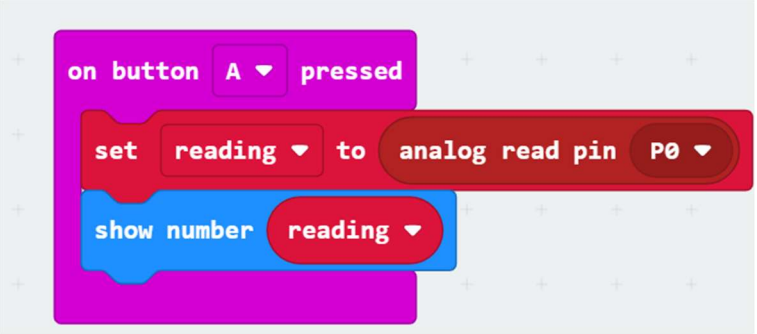
5. Click the **Extension** tab -> Select the **Pins** tab



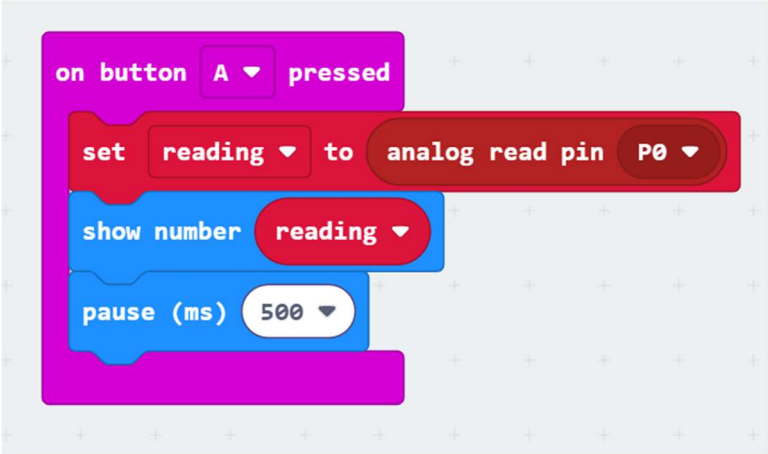
6. Under the **Pins** tab and select and drag “analog read pin P0” into the “0” circle.



7. Go to the **Basic** tab and select and drag “show number 0” -> then go to the **Variable** tab and select and drag the bubble “reading’ to the slot of the “0”.



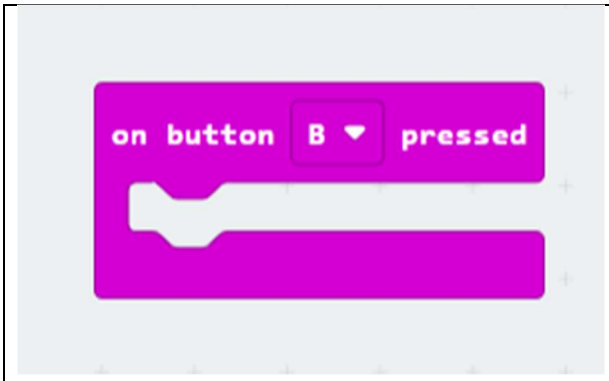
8. Go to the **Basic** tab and select and drag “pause (ms) 100” -> Change 100 to 500



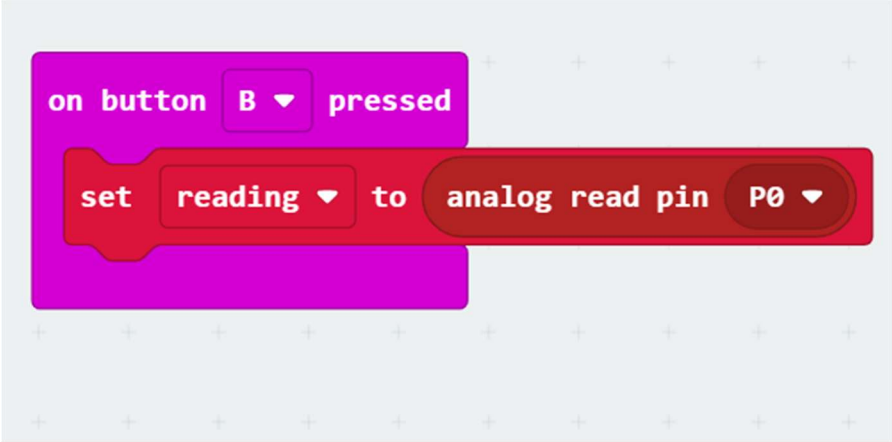
9. Hit **DOWNLOAD** to send the code to the Microbit and then unplug it. Attach a battery pack to keep it turned on.

How to code to give you words instead of numbers.

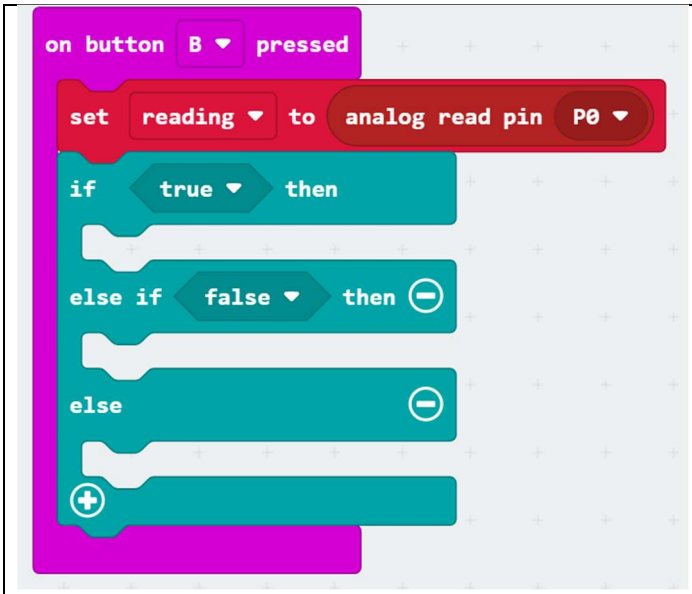
1. Go to the **Input** tab and select “on button A pressed” -> change “A” to “B”.



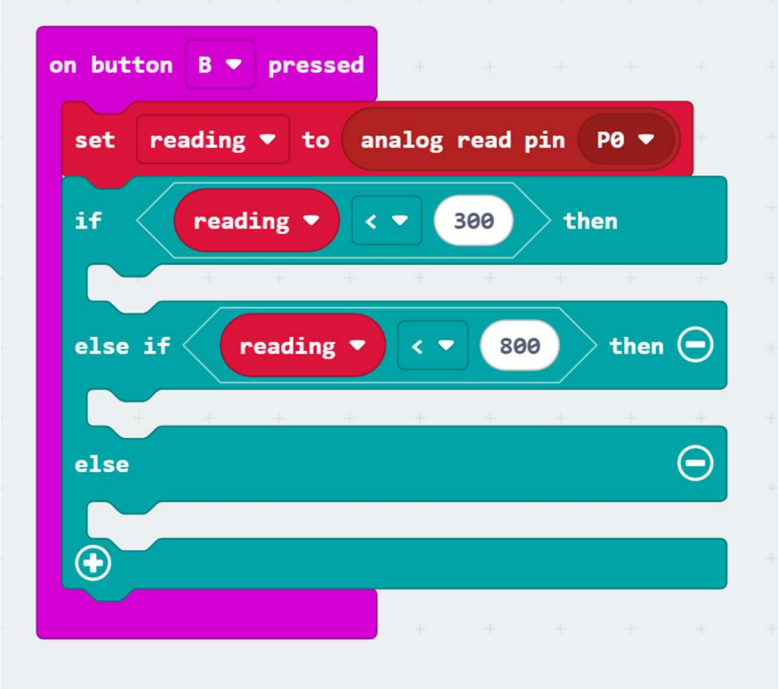
2. Go to the **Variables** tab select and drag “set reading to 0” -> click the **Extension** tab then click the **Pins** tab and select and drag “analog read pin0” drag into the “0” slot.



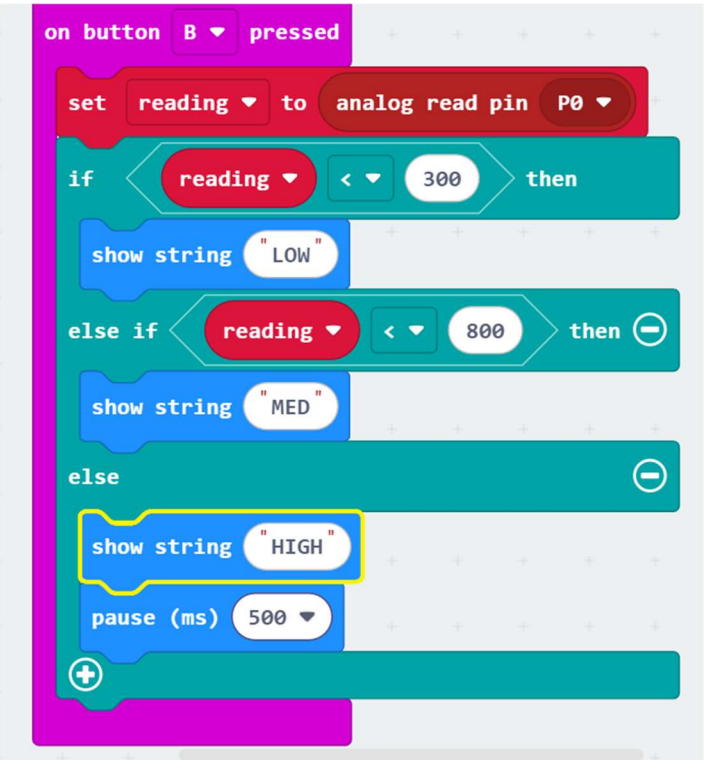
3. Go to the **Logic** tab and select and drag “if true then, else” -> click the “+” at the bottom of the logic block to extend the logic block to “if true then, else if false then, else”



4. Go into the **Logic** tab and under **comparison** and select and drag “0 < 0” to the “true” area.
   -> Go to the **Variables** and select and drag “reading” to the first “0” slot
   -> Change the second “0” to “300”
   ->repeat everything above but instead of “300” write “800”



5. Go to the **Basic** tab and select and drag “show string ‘hello’” change “hello” to “LOW”
   -> Repeat two other times with “MED” and “HIGH”
   -> Go to the **Basic** tab and select “pause (ms) 0” change “0” to “500”



Consolidation/Extension

Test nearby water ways especially in spring to see how much salt is in them

Research new methods to make the roads less slippery without using salt.

Assessment

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Additional Resources

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