SCIENCE NORTH SCIENCE NORD

Together. Ensemble.

Heat Loss and Microbits	Grade 7: Earth and Space

Lesson Plan

Coding Tool	Microbit
Cross-curricular	Coding

Big Ideas

Heat is a form of energy that can be transformed and transferred. These processes can be explained using the particle theory of matter.

Overall Expectations

2. investigate ways in which heat changes substances, and describe how heat is transferred

Specific Expectations

2.3 use technological problem-solving skills to identify ways to minimize heat loss.

2.5 use appropriate science and technology vocabulary, including heat, temperature, conduction, convection, and radiation, in oral and written communication

Description

In this lesson, students will code two Microbits, one that will display temperature and another that will read the temperature and send it via radio to the first Microbit. Using these tools, they will conduct an experiment to create an insulated Microbit that experiences as little heat loss as possible.

Materials

- Insulating materials (Examples:
  - Cardboard
  - Polystyrene foam
  - Newspaper
  - Cotton balls
  - Wool
  - Fiberglass)
- PC/MAC/Chromebook
- Microbits (x2)
- Microbit battery pack (x2)
- Large sealable bag or Tupperware
- Cooler with ice or a fridge

Computational Thinking Skills

- Algorithm
- Conditional (if) statements

Introduction

The use of insulation provides resistance to heat flow, which in turn conserves energy and lowers costs. This is important because in thermodynamics, the study of heat energy, it's stated that energy will transfer from a hot system to a cold one until the two systems are in equilibrium. Instinctively we know this because hot things will lose their energy and cool down. By reducing the rate that they lose that energy, it's possible to make a system more efficient. A well-known example of this is in homes, where insulation is used to minimize heat transfer. The goal is to keep heat in on a cold day, and keep heat out on a hot one.

In this experiment, students will try to reduce heat transfer by insulating a Microbit. That Microbit will relay its temperature to a second Microbit so that students can watch in real time the change in temperature. The best insulated Microbits will experience a slow change in temperature, as it loses heat, whereas one without insulation will transfer all its heat much more quickly.

The insulated Microbit will use radio waves to communicate with the second, which will display the temperature. This can also be an opportunity to discuss radio waves, in terms of either wavelengths or electromagnetic radiation.

Action

To code the two Microbits, start by opening the MakeCode program, a free platform found at the link: https://makecode.microbit.org/

The students will need to code programs separately and upload them to two separate Microbits. To code the Microbits, follow the ***Coding Guide*** which is included as part of this lesson.

Once the students have coded their programs, they can add them to their Microbit using the USB cable. To do so, simply click on the gear symbol and select Pair → Pair Device → Select Micro:bit → Connect

To facilitate the use of the radio features on the Microbit, assign each student or group a number that they will use as their "Radio group number". This will ensure that only their 2 microbits are communicating.

Now that everything is prepared, have students test their temperatures. Start by putting the first Microbit, the one **recording the temperature**, in an empty container. Be sure to keep the interior of your container or zip lock bag dry to protect your Microbit from shorting out. To ensure that it's working, record the temperature that's been output to their 2nd Microbit the one that is **displaying the temperature**. To establish a baseline, this Microbit can be put in a cool place (fridge or cooler) to see how quickly the temperature changes.

Once you've experimented with the Microbit, have the students create an insulated container for their temperature taking microbit. Students can experiment with the different materials to use the one they think will best insulate the Microbit. Place the insulated microbit in the cool place (fridge or cooler) and have students test the temperature differences between their insulated Microbit and the non-insulated Microbit. After the experiments, have students compare their results, which can be facilitated as a group discussion. Use this as an opportunity to discuss the effectiveness of different materials for insulation.

Consolidation/Extension

Have students come up with and create their own experiments using this the Microbit remote thermometer, what other uses it have? How far is the range? How would you create something that would keep the microbit cool in the summer?