SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Monitoring Greenhouse Gases with a Microbit	Grade 9 Earth and Space

Lesson Plan

Coding Tool	Microbit
Cross-curricular	Math (Graphing)

Big Ideas

- Global climate change is influenced by both natural and human factors
- People have the responsibility to assess their impact on climate change and to identify effective courses of action to reduce this impact

Specific Expectations

D2.2 design and build a model to illustrate the natural greenhouse effect, and use the model to explain the anthropogenic greenhouse effect
D3.6 describe how different carbon and nitrogen compounds influence the trapping of heat in the atmosphere and hydrosphere

Description

In this lesson, students will use a Microbit and the temperature sensor to track how heat levels change for closed systems with or without the presence of carbon dioxide.

Materials

- Two BBC Microbits
- Two temperature sensors
- Two beakers/jars
- Carbonated and non-carbonated beverage
- Plastic wrap
- Popsicle sticks
- Heat source

Computational Thinking Skills

- Conditional statements
- Comparison
- Variables

Introduction

Carbon dioxide (CO_2) is a greenhouse gas that absorbs and re-emits infrared radiation. When its molecule absorbs infrared photons, it gains energy and vibrates. This energy can then be transferred to other molecules which causes a further increase in energy. Eventually this energy is given up in the form of another infrared photon but the faster motion of these molecules still results in an increase in temperature of the gases in the atmosphere.

Greenhouse gases such as CO_2 is important for Earth's climate as it retains heat. Without greenhouse gases, the Earth would be an ice planet incapable of supporting life. In recent years however, excess emissions of carbon dioxide from human activity has caused the gases in the atmosphere to heat at a quickened rated. This increase in temperature can have devastating consequences observed in the form of climate change around the world.

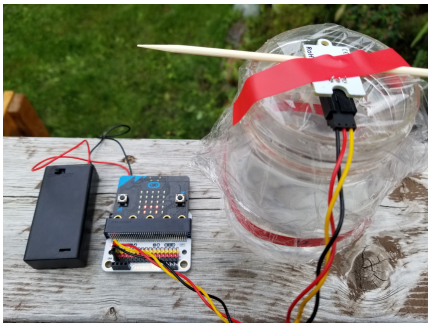
Action

In this lesson, students will use the Microbit and temperature sensor to compare temperatures for closed systems with or without the presence of carbon dioxide.

Experimental Procedure

- Prepare two jars or beakers, one with a carbonated liquid and the other with a non-carbonated liquid. To maintain accuracy, the liquids should be similar, with the level of carbonation being the only difference. One option would be to use carbonated pop and flat pop that has been left open for an extended period of time. Another option would be to use water and carbonated water, which can be store bought or added using a soda stream or Alka-Seltzer tablets.
- Cover the entire opening with plastic wrap to create a closed environment. This is so the CO_2 does not escape.
- Insert the temperature probe from the Microbit by piercing it carefully through the plastic wrap. Popsicle sticks can be used to help support the sensor.
- Place the two jars under a heat source. They can be placed outside in the sun, or under an incandescent light bulb
- Record the changing temperature using the Microbit sensor. Two options for how to code the temperature sensor are provided in the handout.

Set-Up



Have students compare the temperatures of both set-ups after a period of time. Students should observe that the temperature in the closed-system with the carbonated liquid will increase faster and higher as a result of the carbon-dioxide exciting the gas molecules. Discuss what impact elevated carbon dioxide levels can have on a larger scale.

Consolidation/Extension

The desired outcome of this experiment is that students will see the impact that carbon dioxide has on the temperature of the planet. Use this as an opportunity to discuss how students can have an impact on reducing CO_2 emissions and come up with a plan as a group to reduce their own contributions.