# Experiment: Exothermic

**Student Handouts**

# Exothermic 1: Starter Experiment

## Getting Started

If you live in a place where the weather goes below freezing, you can help prevent ice from forming by spreading "salt" on the ground. How does this work?

Throughout this unit, you will investigate the science behind this process – an **exothermic reaction**.

## Learning Goals

- ✓ Follow directions to assemble a simple BasicBoard system that will capture temperature changes as de-icing salt is added to water.
- ✓ Understand how Logo collects and displays measurements from the exothermic system.
- ✓ Describe any patterns you see in the initial data from the exothermic system.
- ✓ Describe how the different components of the exothermic system work together.

## Instructions

**1.** Gather the following materials:

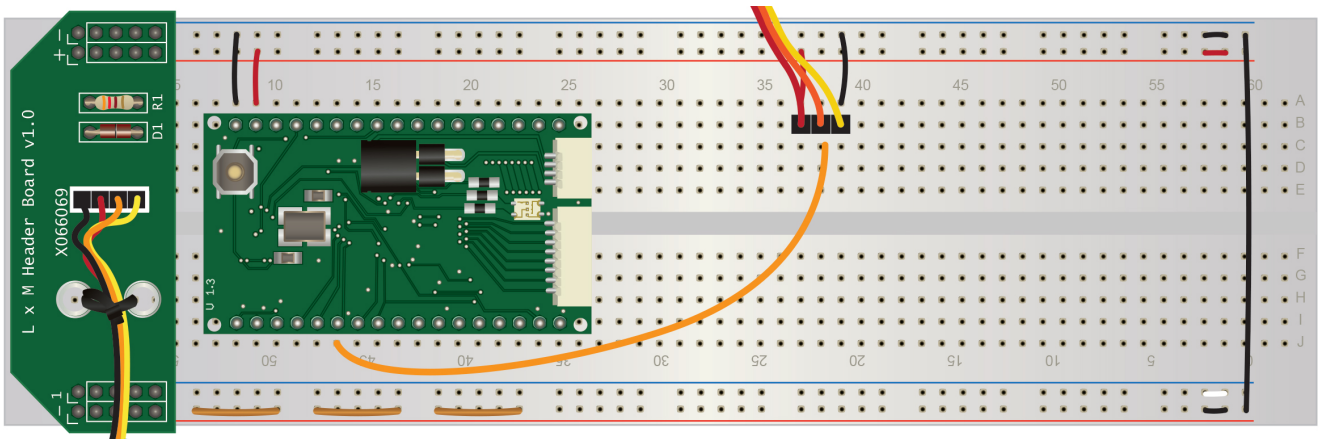
- ☐ BasicBoard and HP Stream
- ☐ Wire as needed
- ☐ Leashed and wrapped temperature sensor
- ☐ A device to measure water volume in *mL* or mass in *g*
- ☐ A device to measure salt mass in *g*
- ☐ De-icing salt

**2.** Fill a cup with 100 mL of water. *This amount of water is equivalent to 100 g.*

**3.** Connect a leashed and wrapped temperature sensor to ADC 5 on the AppBoard.

**4.** Connect power and ground for the leashed temperature sensor.

**5.** Insert the leashed temperature sensor in the cup of water. <u>Do not let water get inside the bag!</u>



6. Plug the FTDI cable into your HP Stream.

7. Create your own working copy of the experiment called **Exothermic** by following these steps. If done correctly, a new black terminal window should pop up that says **Welcome to Logo**.
    - Answer **y** to create a new experiment
    - Select **BasicBoard.tar**
    - Give your experiment a descriptive name. **Record this name in your notebook.**
    - Select the version **Exothermic**

8. Use the command **.edit-project** to open the uLogo and jLogo program files.

9. Open the jLogo file for this experiment. This file ends with the extension **.logo**

10. Locate the word init-calibration. Enter the calibration values **for the sensor that you are using**. Recall, the format is [Reading1 Temperature1 Reading2 Temperature2]

```
to init-Calibration
     make "temp1_cal [6000 4 14000 70]
end
```

11. Save the jLogo file.

12. Reload the experiment with the command **.reload**

13. Compile and download the code to the AppBoard with .**compile** and .**download**.

14. Run the program with **.run-once** and confirm that you see packets printed to the terminal window. A separate graph should pop up and refresh each time a new data point is added.

15. Stop the experiment with the command **..** (two dots).

16. Measure out **5 g** of de-icing salt.

17. Stir the salt into your cup of water.

18. Restart the program with **.run-once** to begin collecting data.

19. Complete the Starter Experiment challenges.

## Challenges

| | Credit | Task |
|---|---|---|
| 1 | ◆ | Draw a simple diagram of your experimental setup. Make sure to indicate the pin on the BasicBoard to which the sensor is attached. Label each component, interaction, and mechanism of this starter experiment. |
| 2 | ◆ | Identify the independent (manipulated) and dependent (respondent) variables in this experiment. What can be changed or controlled? What can be tested? |
| 3 | ◆◆ | Examine the `jLogo` and `uLogo` files for this experiment. Based on what you find in the code, explain what is being printed to the terminal window and what is being displayed on the graph. |
| 4 | ◆◆ | In your notebook, describe any patterns you see in the packets or the graph. How does temperature change over time? How does the rate of change vary over time? |

## *Helpful Hints*

If you need to start over, hold down the **`ctrl`** key and **`c`** at the same time. Next, type the command **`start`** and hit the **`enter`** key.

If you already created the Evaporation experiment, answer **`y`** for **`Would you like to load an existing experiment?`**

If you see **`chip not found`**, call the teacher over.

If you see **`_____ undefined`**, you are trying to run a uLogo word on the AppBoard that it doesn't understand.

If you see **`I don't know how to _____`**, you are trying to run a jLogo word on the HP Stream that it doesn't understand.

If you get an error message, see if you can figure out what you did wrong by asking a classmate for help. If all else fails, ask your teacher.

Watch the FTDI cable during download. If it blinks fast, the AppBoard is working.

Watch the FTDI cable after download. If it slowly blinks red and green, the AppBoard is working.

## *Going Further*

| Extra Credit | Task |
|---|---|
| ◆ | Recalibrate your temperature sensor. This may increase the accuracy of evaporation experiment measurements. |
| ◆◆ | Research how food scientists use water to determine how many calories are in the food you eat.<br>Water is used to set many of the measurement scales in the International System of Units. The freezing point of water is 0 degrees Celsius. The boiling point is 100 degrees Celsius. If you poured water into a cube with sides 1 cm in length, the water would weight 1 g and the volume would be 1 mL. |