

# TEMPERATURE SCALES AND FREEZING POINT DEPRESSION

## LAB PP 6.CALC

### INTRODUCTION

Temperature refers to the level of hotness or coldness of an item. People rely on temperature measurements in a variety of ways. Sometimes we use our bodies to estimate the temperature of other things, like when we stick our toe in a swimming pool to see how cold it is or when we put our hand on someone's forehead to check if they have a fever. When the situation requires a more accurate temperature measurement, we use thermometers. Thermometers vary, depending on the temperature scale they are based on.

**Figure 1: Common Temperatures in Celsius and Fahrenheit**

Description	°C	°F
Freezing water temperature	0	32
Boiling water temperature	100	212
Comfortable room temperature	22	72
Normal body temperature	37	98.6
Hot tap water temperature	60	140

In the United States, we commonly use the Fahrenheit scale to measure temperature, but the Celsius scale is used in scientific measurements and in most other countries. This activity introduces the Celsius temperature scale and compares measurements made in Celsius and Fahrenheit. Figure 1 compares common temperatures measured in Celsius and Fahrenheit. This activity also introduces the concept of freezing point depression. The use of salt to melt ice and snow on roads is a common example of the phenomenon of freezing point depression.

### PURPOSE

The purpose of this activity is to introduce and increase familiarity with the Celsius temperature scale. Students will also observe an example of freezing point depression.

## **EQUIPMENT/MATERIALS**

TI graphing calculator with DataRad  
LabPro interface and AC adapter  
Temperature Probe  
Packets of salt

Ice cubes  
Paper towels  
Samples of liquids at various temperatures

## **SAFETY**

- Always wear an apron and goggles in the lab.
- Use caution handling hot liquids.
- Do not eat or drink in the laboratory.

## **PROCEDURE**

1. Connect the temperature probe to the LabPro CH1.
2. Make sure that the LabPro is connected to the calculator.
3. Turn ON the calculator and press APPS.
4. Select the DataMate application from the list of applications displayed.
5. Press CLEAR. The message “CHECKING SENSORS” will be displayed.
6. The temperature displayed is the temperature of the probe. Hold the metal part of the probe in your hand. What happens to the temperature that is displayed? Record your observations in Table 1 on the Data Sheet.
7. Obtain an ice cube and place it on a paper towel.
8. Gently press the tip of the probe against the top of the ice cube. What temperature is now displayed on the calculator screen? Record the temperature displayed and your observations in Table 1 on the Data Sheet.
9. Once the temperature has stabilized, pour the contents of a small packet of salt onto the top of the ice cube.
10. Gently press the tip of the probe against the top of the ice cube. What is the temperature now? What is happening to the ice cube? Record the temperature displayed and your observations in Table 1 on the Data Sheet.

11. Plug a second temperature probe into CH2 and set-up this probe to measure temperature in °F, by following the instructions given below:
  - a. Press 1 to select Setup.
  - b. Move the cursor next to CH2 and press ENTER.
  - c. This will take you to the SELECT SENSOR screen. The probes are in submenus. For example, 4:PRESSURE displays all of the pressure probes.
  - d. Select 1 for TEMPERATURE. If the probe that you want is not listed, press 7 for MORE probes.
  - e. Select 5 for STAINLESS TEMP (F).
  - f. The message “SETTUP UP CHANNEL...” will be displayed.
  - g. CH 2 should now display STAINLESS TEMP (F).
  - h. Select 1 for OK.
  - i. Measure temperatures of different cold, warm and hot liquids with both probes to see the temperature in °C and °F. Record the liquids used and the temperatures observed in Celsius and Fahrenheit in Table 2 of the Data Sheet..
  - j. (Optional, for upper grade levels) Use either the calculator or *Logger Pro 3.1* to graph °F vs. °C to determine the conversion equation for °C to °F. Record the equation on the Data Sheet.
  
12. When you have completed the experiment, press 6:QUIT to exit DataMate.

**DATA SHEET**

Name \_\_\_\_\_

Name \_\_\_\_\_

Period \_\_\_\_\_ Class \_\_\_\_\_

Date \_\_\_\_\_

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**DATA TABLES**

**TABLE 1**

Probe Conditions	Temp. (°C)	Observations
In hand		
On ice cube		
On ice cube with salt		

**TABLE 2**

Description of Liquid	°C	°F

(Optional) Use a graph of °F vs. °C from the data in Table 2 to determine the conversion equation to go from °C to °F.

Conversion equation for °C to °F: \_\_\_\_\_