



### Science Objectives

- Students will learn about linear relationships.
- Students will perform data collection and analysis.
- Students will graph data and draw conclusions based on the graph.
- Students will determine linear regression equations.

### Vocabulary

- Temperature scale
- Celsius
- Fahrenheit
- Linear regression

### About the Lesson

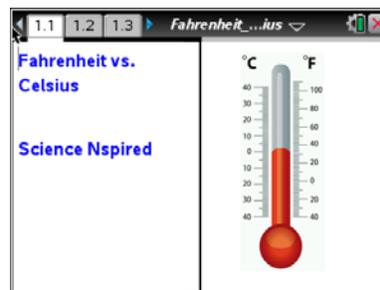
- This lesson involves gathering temperature data simultaneously with two probes - one measuring Fahrenheit and the other Celsius.
- As a result, students will:
  - Become familiar with TI-Nspire™ CX technology and the DataQuest application.
  - Use two Temperature Probes to make measurements.
  - Use a graph to make conclusions about the experiment.

### TI-Nspire™ Navigator™ System

- Send file to students.
- Use Class Capture to monitor student progress.
- Collect and grade .tns file.

### Activity Materials

- TI-Nspire CX handheld and TI-Nspire™ Lab Cradle
- Two 250 mL beakers
- 2 Vernier® stainless steel temperature probes
- Tap water
- Ice cubes
- Paper towels



### TI-Nspire™ Technology Skills:

- Open a document
- Move between pages
- Gather data using the Vernier DataQuest™ app
- Analyze data

### Tech Tip:

Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

### Lesson Files:

#### Student Activity

- Fahrenheit\_vs\_Celsius\_Student.pdf
- Fahrenheit\_vs\_Celsius\_Student.doc

#### TI-Nspire document

- Fahrenheit\_vs\_Celsius.tns

## Discussion Points and Possible Answers

TI-Nspire Navigator Opportunity: *Class Capture*  
See Note 1 at the end of this lesson.

Move to pages 1.2 and 1.3.

Answer the following questions on your handheld.

Q1. Nearly the entire world uses the \_\_\_\_\_ temperature scale.

**Answer:** D. Celsius

Q2. The United States uses the \_\_\_\_\_ temperature scale.

**Answer:** B. Fahrenheit

Move to page 2.1.

1. Pour about 100 mL of tap water into a 250 mL beaker.
  2. Connect the TI-Nspire™ Lab Cradle to the TI-Nspire CX CAS handheld.
  3. Connect two Vernier® Stainless Steel Temperature Probes to the TI-Nspire Lab Cradle (see the photo to the right).
  4. In the Vernier DataQuest App, set up the data-collection mode by selecting **MENU > Experiment > Collection Mode > Events with Entry**.
  5. Enter **Temp** as the Name, leave the Units field blank, and click OK.
  6. Select **MENU > Experiment > Setup Sensors > Change Units**, and select Fahrenheit for Stainless Steel Probe 2. Click **OK**.
  7. Start data collection by pressing the **Start** button .
- You will measure the temperature of one group member's hands in both Celsius and Fahrenheit.
8. The volunteer should pick up the two Temperature Probes and simultaneously hold their tips in the palm of the same hand as shown to the right.





9. Watch the live temperature read out. When the temperature stops rising, click the **Keep** button .
10. You will be prompted to enter a number. Type **1** to number the first temperature measurement trial, and click **OK**.
  - The two temperature measurements have been saved.
11. Place the two Temperature Probes simultaneously in the tap water.
12. When the temperature stabilizes, click the **Keep** button , and type **2** for the second trial when prompted. Click **OK**.
13. Add several ice cubes to the beaker of tap water. Stir using both probes. When the temperature stops decreasing, click the **Keep** button , and enter **3** when prompted. Click **OK**.
14. Click on the **Stop**  button to stop data collection.
15. Select **MENU > Graph > Select Y-axis Variables > run1.Temperature 2**.
16. Select **MENU > Graph > Select X-axis Variable > Temperature**.
17. Select **MENU > Analyze > Curve Fit > Linear**.

18. What is the slope of the line? \_\_\_\_\_  
What is the y-intercept? \_\_\_\_\_

**Answers:** ~1.8; ~32

19. Explain the meaning of these values.

**Answer:** The slope indicates the fact that a change of one Celsius degree is equivalent to a change of 1.8 Fahrenheit degrees. The y-intercept indicates that 0 degrees on the Celsius scale is equivalent to 32 degrees on the Fahrenheit scale.

**Move to pages 3.1 through 3.3.**

- Q3. What type of relationship exists between Celsius and Fahrenheit temperatures?

**Answer:** D. Linear

- Q4. The slope of the Fahrenheit vs. Celsius graph represents the fact that a change of one Celsius degree is equivalent to a change of \_\_\_\_\_ Fahrenheit degrees.

**Answer:** Approximately 1.8. Student answers may vary.



Q5. The y-intercept of the Fahrenheit vs. Celsius graph should indicate the freezing points of water on the Celsius and Fahrenheit scales, respectively.

**Answer:** True

### Extension

Students will analyze the changes in the mathematical model when the temperatures are graphed with Celsius on the y-axis and Fahrenheit on the x-axis.

### Return to page 2.1.

1. Select **MENU > Graph > Select Y-axis Variables > run1.Temperature.**
2. Select **MENU > Graph > Select X-axis Variable > Temperature2.**
3. Select **MENU > Analyze > Curve Fit > Linear.**
4. What is the slope of the line? \_\_\_\_\_ What is the y-intercept? \_\_\_\_\_

**Answers:** ~.56; ~ -17.8

5. Explain the meaning of these values.

**Answer:** The slope indicates the fact that a change of one Fahrenheit degree is approximately equivalent to a change of 0.56 Celsius degrees. The y-intercept indicates that 0 degrees on the Fahrenheit scale is approximately equivalent to -17.8 degrees on the Celsius scale.

6. Disconnect the Temperature Probes.
7. Properly dispose of the water in the beaker.

### Move to page 3.4.

Q6. The slope of the Celsius vs. Fahrenheit graph in the Extension is the \_\_\_\_\_ of the slope from the Fahrenheit vs. Celsius graph.

**Answer:** C. reciprocal

### Wrap Up

Upon completion of the discussion, the teacher should ensure that students are able to understand:

- The relationship between the Fahrenheit and Celsius temperature scales.

### Assessment

Students will complete the embedded multiple choice questions in the Fahrenheit vs. Celsius .tns file. In addition, students will answer questions on the student activity sheet.



**TI-Nspire Navigator**

**Note 1: Class Capture**

Use Class Capture to monitor student work throughout the activity.

**Note 2: Portfolio and Slide Show**

Use the TI-Nspire Navigator to collect, grade, and save the .tns file to the Portfolio. Use the Slide Show to view student responses.