College Prep Chemistry Core Lab #10
40 points

Celsius vs. Fahrenheit

The History:

The scale we know as the Fahrenheit scale (°F) became popular when Daniel G. Fahrenheit manufactured the first commercially available mercury-in glass thermometers. As the zero point on his scale Fahrenheit chose the temperature of a bath of ice melting in a solution of common salt, a standard 18th century way of getting a low temperature in the laboratory (and in the kitchen, as in an old-fashioned ice cream churn). He set 32 degrees as the temperature of ice melting in water. For a consistent reproducible high point he chose the temperature of the blood of a healthy person (his wife), which he measured in the armpit and called 96 degrees. (The number arises from beginning with a scale of 12 intervals, like a one-foot ruler, and then doubling the number of steps as instruments become more precise, making 24 intervals, then 48, and finally 96.) From these two temperatures he was able to determine the size of a Fahrenheit degree. Fahrenheit's successors used the boiling point of water to calibrate their thermometers, which they set at 212 degrees in order to retain the size of Fahrenheit's degree.

The degree Celsius (°C) scale was devised by dividing the range of temperature between the freezing and boiling temperatures of pure water at standard atmospheric conditions (air pressure at sea level) into 100 equal parts. Temperatures on this scale were at one time known as degrees centigrade. However, it is no longer correct to use this terminology.

In this lab, you will determine the mathematical formula for the conversion of Fahrenheit and Celsius temperatures.

Objective:

Introductory Paragraph:

Hypothesis:

- Research and provide the equation for the conversion of Fahrenheit to Celsius.
- Identify the slope and the y-intercept from the equation.
- Based on the information above, sketch a small diagram of what you think the graph will look like.

Procedure:

a. Use two temperature probes and a LabPro to collect the temperature of a sample of water in both scales. (Use EasyData in Apps. Press File then New and enter to clear old information).

b. Fill a 600 mL beaker about ¾ full with tap water and place on a hot plate as demonstrated by your teacher.

c. Probe 1 (channel 1) should be Celsius and probe 2 (channel 2) should be Fahrenheit. These can be set by going into the "setup" option on the menu. (Edit, Unit)

d. You will have to change the data collecting information by pressing "Setup" and selecting the "Time graph" option. You will have 10 seconds between intervals for 170 intervals which will automatically program for 1700 total seconds of data collection.

e. Return to the main screen**. Be sure to check that the temperature senor wires are not touching the hot plate.** Turn on the hot plate. Press **Start** to begin data collection.

f. The graph should appear on the display screen – be sure that it does.

g. The calculator will let you know when it is done. You can stop the data collection when the water has boiled for a few minutes.

h. Graph (L_2,L_3) and wait for your teacher to explain how to determine the slope using the Stat Calc function.

i. Sketch the graph into the data section of your lab. Make it ½ page and don't forget the title and unit labels. Write the equation for the line next to the graph using appropriate variables.

Data: 1. Construct a graph (Figure 1): Degrees Fahrenheit as a function of Degrees Celsius

2. Using the calculator, determine the equation. Label and record the equation in the white space on the graph. Be sure to use variables appropriate to the graph.

Analysis:

1. Figure 2: Stem and Leaf of temperature equation slopes
2. Fig. 3: Stem and Leaf of y-intercept for temperature equations
3. Table 1: Summary of temperature data (should include n, range, and median for each stem and leaf plot)
4. Percentage Error Calculation for each (slope and Y-intercept)

Analysis Questions:

1. Use class the combined class equation to perform the following conversions:
   a. 33.0 ^{o}C to ^{o}F
   b. 200.0 ^{o}F to ^{o}C

2. Is the relationship between ^{o}F and ^{o}C linear? Is it a direct proportion? Support your answer.

3. The equation determined from the graph will convert ^{o}C to ^{o}F. Manipulate the equation to determine the equation for ^{o}F to ^{o}C ? (^{o}C = ?)

4. Use the equation from the graph to find the temperature when ^{o}C = ^{o}F. (Hint: make the two variables the same) Show work.

Conclusion:

Remember: No method in the conclusion.

College Prep Chemistry Core Lab #10
40 points

Celsius vs. Fahrenheit Rubric

Format **5 points**

- Appropriate use of titles, units, significant digits and labeling
- Use of ruler or straight edge.

Introductory Paragraph **6 points**

- Appropriate definitions
- Brief method
- Chemistry explained

Hypothesis **3 points**

- Hypothesis written appropriately

Data/Results **15 points**

- Graph sketched and labeled from calculator appropriately (2)
- Equation of line (2)
- Stem and Leaf (2)
  - Scale /Key
- Summary data table (2)
  - N, R, M
- Percent Error (2)
  - Formula, substitution, and answer
- Analysis questions answered correctly (5)

Conclusion **11 points**

- Address objective
  - What did you determine the answer to be? (median)
  - Evidence/support from lab
- Report individual group result
- Comparison to hypothesis
- Reliability of data
  - evidence
- Conclusion quality: well organized and cohesive and contains no mechanical/grammatical errors. (3)
  - Well organized and cohesive but contains grammatical or mechanic (2)
  - Somewhat organized but does not contain any errors (2)
  - Somewhat organized with some errors (1)
  - Disorganized with errors (0)