

Name: _____
 Last, First, Session 011, 012, or 013

Grade: _____ / 100 points total

Brief Report for Thermocouple Lab – Due Sept 14

Please use measurements from both team's thermocouples in addressing the questions below. Keep in mind that this should be a brief write-up about the main points of the lab – no formal format is required. Succinctly, show that you understand the main points of the lab. Be clear about your use and understanding of precision and accuracy and use significant figures properly. Use the following outline to minimize your report while demonstrating your knowledge.

_____/20 **Voltage Measurements and Errors:** This section only applies to the measurements using the ice or boiling water as a reference bath. Create a test matrix spreadsheet whose first two columns have a heading of **Measurement Type and Reference Type**. Provide a **third column of Measured Voltages** and a **fourth column for the estimated observed error, all in microvolts**. **Add a fifth column** that computes the **error in each Measured Voltage** by applying the **34461A multimeter error calculation**. **Add a sixth column** that provides your estimate for the particular **reference voltage**. **Add a seventh column** that records the **observed voltages when placing both thermocouples in the ice bath** (this is one value that pertains to the ice bath-ice bath experiment). **Add an eighth column** that estimates the **object's voltage** and a **ninth column** that estimates the **object's uncertainty**. For the body temperature measurements, only present one measurement for this section of the lab report.

Be sure to include the sign of your voltage readings and make proper use of significant figures in reporting these values. **Provide all the equations used to compute the values and a brief description.**

_____/20 **Room Temperature Measurement with Ice-Bath Reference:** Provide a Table of your temperature estimate of the room, temperature error, and ITLL room temperature. To compute temperature error, use the observed voltage error and add or subtract that value from the voltage measurement and then recompute the temperature to get a range. Provide the equations used to compute each value and discuss your observations. Is there a significant variation between thermocouple estimate and ITLL room temperatures?

_____/20 **Body Temperature Measurement with Ice-Bath Reference:** Plot the 10 body temperature measurements with an error bar for each (computed in a similar manner as for room temperature) with the x-axis ranging from 1-10 and the y-axis having a temperature range in °C. Also plot an estimate of the weighted mean and the deviation about the mean using the 10

measurements. Plot these temperature values as a straight line from the y-axis. Briefly discuss your observations.

_____/10 **Boiling Water Temperature Measurement with Ice-Bath Reference:** Provide an estimate of the boiling water temperature and its error and compare with a web search for the expected boiling temperature at the recorded atmospheric pressure. Briefly discuss observations and findings.

_____/10 **Room Temperature Measurement with Boiling Water Reference:** Provide a table of the room temperature estimate, its error, and ITLL room temperature. How does this estimate compare with the ice-bath reference measurement and what might be the cause of any differences when using two different references?

_____/15 **CJC Room and Boiling Water Temperature Measurement:** Provide a Table of temperature estimate and error from the CJC measurement for both the ITLL room temperature and the estimate of boiling water. Compare and discuss the accuracy and precision of the CJC measurement with the thermocouple estimates of room temperature and boiling water using the ice-bath reference measurement. All four thermocouple measurements should be used in this assessment.

_____/5 **Conclusions:** What is your conclusion about the precision and accuracy of using thermocouples for measuring temperature? How might some assumptions or uncertainties affect your outcomes?