# Carleton University

## Laboratory Report

**Course #:** PHYS1003-A                    **Experiment #: 01**

# <u>Thermocouple</u>

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## Purpose

The purpose of this experiment is to determine the sublimation temperature of solid CO2 ("dry ice").

## Theory

Thermocouples produce an emf when the two sides are at different temperatures. Higher temperatures increase average electron energy within the metal, increasing the speed which electrons leave the metal. Therefore, there will be a potential between two leads of the same metal at different temperatures.

## Apparatus

Thermocouple

Temperature probe (+- 0.3 K)

Vernier instrumentation amplifier (+- 0.02 mV)

Power supply

Calorimeter

## Observations

## Calculations

## Results

# Discussion

-Do you expect Equation 5.2 to provide accurate extrapolation of $\Delta V$ at $T=100°C$? Which is better: the equation or the graphical extrapolation?

- Do you expect Equation 5.2 to be accurate when finding sublimation temperature of dry ice? Why or why not?

- What results where you expecting for each of your consistency tests? Why? Did you obtain what you expected?

- What type of thermocouple are your using? Is Equation 5.1 an adequate representation of the temperature and voltage dependence for this type of thermocouple?

- What is the purpose of putting ice into the cold junction? Can the experiment be done without it?

The purpose of the ice in the cold junction was to keep the water and wire at a constant temperature.

- Why did you need to stir the water in the hot junction and occasionally shake the cold junction can?

- Why was the alcohol slurry necessary?

- Why is solid $CO_2$ is referred to as 'dry ice'? Is there such a thing as 'wet ice'? Is it possible to skate on dry ice? Why or why not?

It is referred to as dry ice because it is cold, has an appearance roughly like ice, but does not melt under STP. "Wet ice" would be solid $H_2O$, which melts under STP. It would not be simple to skate on dry ice, for two reasons. One would be that the person skating would freeze to death. Barring that, dry ice does not melt when subject to pressure, unlike regular ice. This thin layer of liquid is what allows ice skating.

| Part of the Experiment | Values being compared | | $\Delta$ | $\sigma\Delta$ | $\Delta\sigma\Delta$ | Consistent? (Yes or NO) |
|---|---|---|---|---|---|---|
| Part 1: Calibration | | | | | | |
| | | | | | | |
| Part 2: Sublimation of $CO_2$ | | | | | | |
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