

Progress Report #7

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Governor's School at Innovation Park

COS120: Introduction to Research

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Objectives

In the past few weeks, our team has officially set up our apparatus, created 19 different samples of concrete for testing, and have collected data for two of our trials at various times over 5 minute intervals for each sample and labeling the maximum or peak, totaling 380 usable data points thus far. In the coming days we hope to have all of our trials fully completed, analyze our data, finish writing our full research paper, and to successfully present our data to fellow researchers and science enthusiasts at our final's presentation and the Governor School's Research Symposium.

Materials & Methods

All concrete samples have been coated with copper foil ends to ensure proper conduction for our copper trials as shown in the images below:



Figures 1 and 2 display our samples with copper foil end caps for the C72 and C32 trials. Photo taken by author on April 16th, 2026.

The multimeters and thermocouple in our team's apparatus have been fully set up and tested to ensure proper functionality. An image of the K-Type Temperature probe attached to our temperature-measuring multimeter is pictured below. This was used initially to ensure proper starting temperatures prior to each trial.



Figure 3 shows the setup of the thermocouple to ensure accurate starting temperatures at the beginning of each trial. Photo taken by author on April 16th, 2026.

Our data collection consisted of 4 trials. One with copper end caps at 72° (C72), one without copper end caps at 72°(N72), one with copper end caps at 32°(C32), and one without copper end caps at 32°(N32).

Because of Manassas Park's Library having temperature-controlled rooms, our team was able to maintain a reliable outside temperature over the course of our trials. In our trials on April 16th and 17th in their [Study Rooms](#). These rooms were set to an internal temperature of approximately 72°F. In our trials with coolant, we utilized ice water that measured at approximately 32°F.

For safety, we have determined that sunglasses in the lab are not optional, which in addition to making us look really cool, provided us with protection from the brightness of the heat lamp as pictured below.

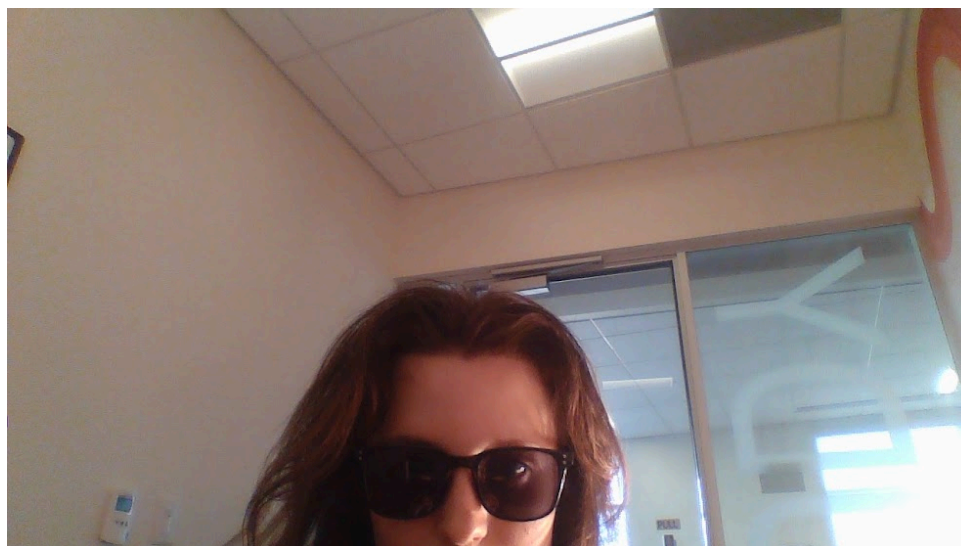


Figure 4: Personal Protective Equipment in the lab. Photo taken by author on April 17th, 2026.

Data/Results

We first started with the C72 trial. The values measured were then recorded in an Excel table as shown below.

Heat Lamp Trials with copper ends and cooled side of 32 ° (mV produced)											
SAMPLE	1	1.5	2	2.5	3	3.5	4	4.5	5	MAX	
control	0	0	0	0	0	0.1	0.1	0.1	0.1	0	0.1
less water	0.2	0.1	0.1	0.1	0	0	0	0	0	0	0.2
iron	0.1	0.2	0	0	0	0	0	0	0	0	0.2
cf	0	0	0	0	0	0.1	0.1	0.1	0	0	0.1
gp	0	0	0	0	0	0	0.1	0.1	0.2	0.3	0.2
fa	0	0	0	0	0	0	0	0	0	0.1	0.1
iron + cf	0	0.1	0.02	0	0	0	0	0	0	0	0.2
iron + gp	0.2	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0	0.2
iron + fa	0	0	0	0	0	0	0	0	0	0	0
cf + gp	0	0	0	0.1	0.1	0.1	0	0	0	0	0.1
cf + fa	0	0	0	0	0	0	0	0	0	0	0
gp + fa	0	0	0	0	0	0	0	0	0.1	0	0
iron + cf + gp	0.2	0.4	0	0	0	0	0.1	0.1	0.1	0	0.4
iron+cf+fa	0.1	0.1	0.1	0.2	0.2	0.3	0.1	0.1	0	0	0
iron + gp + fa	0.1	0.1	0.1	0.2	0.4	0	0	0	0	0	0
cf + gp + fa	0	0	0	0	0	0	0.1	0.1	0.2	0	0
everything	0	0	0	0	0	0	0	0.1	0	0	0.1
iron+cf+fa X2	0.2	0.2	0.3	0.5	0.1	0.1	0	0	0	0	0
less water all	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2

Figure 5: mV produced from samples in the C72 trials

The voltage produced by the C27 trial was much lower than previously hypothesized; however, we theorize that the copper may be reflecting back and blocking a large amount of the applied heat rather than aiding in the absorption heat and conduction of the electricity as previously theorized.

Our team noted that the samples with less water or more of the added materials on average absorbed heat and created electricity earlier than the samples found with more water but then quickly dissipated that energy. We theorize that this may be due to the samples holding a lower heat capacity or

In our second trial, we began measuring the copper covered concrete with one end being placed in a properly made ice bath according to an article from ThermoWorks that allowed the cool side to measure at approximately 32°F (Thermoworks). The other side of the concrete was then hit with the heat lamp. The results of this trial is shown below

ACTUAL DATA (Heat Lamp Trials with copper ends + cool side of 32)											
SAMPLE	1	1.5	2	2.5	3	3.5	4	4.5	5	MAX	
control	0.1	0.1	0	0	0	0.1	0.1	0.1	0	0.1	0.1
less water	0.4	0.3	0.1	0.1	0	0	0	0	0	0	0.4
iron	0.1	0.2	0	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.3
cf	0	0.1	0	0	0	0	0	0	0	0	0.1
gp	0.1	0.2	0.1	0	0	0.1	0.2	0	0.1	0.2	0.2
fa	0	0	0	0.1	0.1	0.1	0.1	0	0	0	0.1
iron + cf	0	0.1	0	0	0	0.1	0.1	0	0	0	0
iron + gp	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2
iron + fa	0	0	0	0	0	0	0	0	0	0	0
cf + gp	0	0	0	0.1	0.1	0.2	0	0.1	0.1	0.1	0.1
cf + fa	0.2	0.3	0.1	0.5	0.4	0.2	0.1	0.1	0.1	0.1	0.5
gp + fa	0.1	0.1	0	0	0.1	0.1	0	0	0	0	0.1
iron + cf + gp	0	0	0	0	0	0	0	0	0	0	0
iron+cf+fa	0.4	0.2	0.1	0.2	0.5	0.2	0.1	0	0	0	0.4
iron + gp + fa	0.1	0	0	0	0	0	0	0	0	0	0.1
cf + gp + fa	0.1	0.1	0.1	0.2	0.4	0.1	0.1	0.2	0.1	0.1	0.4
everything	0	0.2	0.1	0.1	0	0.2	0	0	0	0	0.2
iron+cf+fa X2	0.1	0.1	0	0.1	0.2	0	0	0	0	0	0.1
less water all	0.1	0.1	0	0	0	0	0	0	0	0	0

Figure 5: mV produced from samples in the C32 trials

After finishing our C72 and C32 trials, we began our trials without copper end caps. Data will be updated as the trials are completed.

References

Create a Proper Ice Bath. (2025). ThermoWorks.

<https://www.thermoworks.com/pages/thermapen101-creating-an-icebath>