

Group 1: Reflection Pond Algal Blooms

The Reflection Pond is located in front of the Cooper Library on Clemson University's campus. The pond is a staple on Clemson University's campus where students flock to hang out next to and spend time. The pond contains 1,960,000 gallons of water and is cleaned once a year. Around graduation, students go floating/swimming in the reflection pond to celebrate their accomplishments!

Over the past couple of weeks, you have been growing algae from Reflection Pond water by providing the water with varying levels of different nutrients including: Full Algae Nutrient, Sodium Phosphate (Na_3PO_4), Sodium Nitrate (NaNO_3), and light sources (high light, normal light, and low light). You have also been measuring color, scent, turbidity (in some cases), and we've been measuring pH behind the scenes.



Figure S1.1. The Reflection Pond outside of the Cooper Library at Clemson University.

Definitions of Different Nutrients Supplied to Local Algal Growth to Help Decipher the Below Data:

Full Algae Nutrient:

NaNO_3	75 g/L dH_2O	1 mL	$8.82 \times 10^{-4}\text{M}$
$\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$	5 g/L dH_2O	1 mL	$3.62 \times 10^{-5}\text{M}$
Na_2CO_3	30 g/L dH_2O	1 mL	$1.06 \times 10^{-4}\text{M}$
Trace Metal Solution		1 mL	---
Vitamin Solution		0.5 mL	---



Figure S1.2. High Light, Normal Light, and Low Light algae bottles after 11 days.

Sodium Phosphate (Na_3PO_4):

It's a chemical compound containing sodium and phosphate ions. It comes in different forms, including phosphate (TSP), disodium phosphate (DSP), and monosodium phosphate (MSP).

Some examples of uses would be:

- Used in cleaning products and as a food additive (TSP)
- Found in food products and acts as a buffering agent (DSP)
- Used in food products and as a pH regulator in industrial processes (MSP)

Sodium Nitrate (NaNO_3):

Sodium Nitrate is also a chemical compound, but instead of phosphate it contains nitrate. Sodium Nitrate is often used in industrial and agricultural applications. Examples of usage of Sodium Nitrate include fertilizer, food preservation, and explosives. On the other hand, Sodium Nitrate is also a key nutrient that contributes to algal growth. A high concentration of sodium nitrate in water environments may therefore decrease the water quality by increasing the amount of algal blooms.

Objective: Determine what factors encouraged algae growth based on your in class experiment data by graphing and running at least one statistical test.

Access In-Class Algal Bloom Data: [here](#)

Instructions for Graphing:

To create a graph of algal bloom data, the first step should be to assess which data points go along the x versus the y-axis. Most data provided contains some form of information relative to time like a date or a year. This information should be placed along the x-axis, with anything like pH or color (measured numerically) on the y axis. For example, if you wanted to see how the pH changed over time, you could place the time on the x-axis with the pH on the y-axis.

Other information to keep in mind when graphing is including information like a title, legend if appropriate, axis title, titles for the axes, as well as an appropriate trendline. Google Sheets will likely populate most of this information, but you should review the details before proceeding. For example, it will auto-populate as a line graph, but typically a scatter plot with a trendline is more appropriate for scientific data, especially if we want to derive an equation.

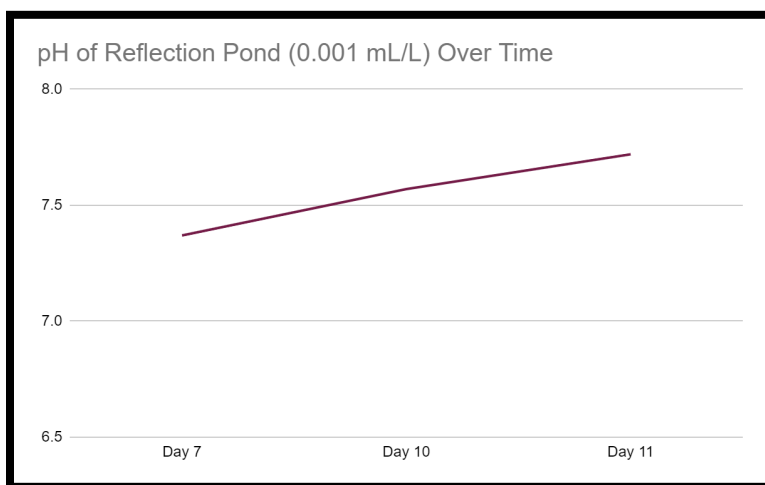


Figure S1.3. Example of a graph generated in Google Sheets.

In Google Sheets, a graph can be created by selecting two columns of data, clicking insert, and then chart. From here, you can change the graph type to a scatter plot within 'Chart Editor'.

Running a Statistical Test:

A t-test is a statistical test that allows you to determine if the means of two sets of data are different. In a t-test, one output is a p-value, and this value will help determine if the means are statistically different.

When running a t-test, there are certain assumptions that need to be made about your data. One assumption is that your data is normally distributed. Normally distributed data is where your data occurs evenly around the mean, with data points near the mean occurring more frequently than data far from the mean. There are several tests you can run to determine if your data is normal, but **for this activity, we will assume our data is normally distributed and proceed with a t-test.**

To run a t-test in google sheets you will use the function T.TEST. To compare means you will need two lists of data. These are often columns in a dataset and can be selected by entering the range of cells. A range includes the following the first datapoint in the column, a colon, and the last datapoint in the column (ex. A1:A30).

To run a t-test, you will enter the following equation into an empty cell in your document:

=T.TEST(Range 1, Range 2, 2, 2)

The end of that equation has two numbers separated by a comma, shown in red. These tell Google Sheets what function to use, and you should just leave them alone. From your t-test you will get an output called a p-value. Based on the results of your t-test, you can make conclusions about your data. If $p < 0.05$, the means between groups are different. If $p > 0.05$, means between groups are the same.