



Education and Research: Testing Hypotheses

## Gardening in the Arctic

### Summary

Using the data from Dr. Victoria Hill's Arctic Buoy Research, students will analyze how light, temperature and nutrients impact phytoplankton growth. Graphs will be generated from Buoys #1 and #3 that captured chlorophyll data. Students will explore which factor contributes the most on phytoplankton growth: light or temperature. Additionally, light intensity will be investigated for growth impacts in a lab setting. Graphing skills, scientific method skills, and utilizing authentic science data are developed.

*[TAGS: phytoplankton, chlorophyll, Arctic, research, buoy, upwelling.]*

### Key Concepts

- Align with the NGSS Disciplinary Core Ideas (Orange foundation box):  
<http://www.nextgenscience.org/search-standards-dci>

### Objectives

Students will:

- Graph time versus light intensity, time versus temperature, time versus nutrients for Buoy #1 (temp only) and #3
- Compare graphs for connections
- Create hypotheses with light and temperature impacts on phytoplankton density
- Determine whether light or temperature has a stronger effect on phytoplankton
- Design an experiment with phytoplankton growth based on light intensity

### Materials

- Background information on WARM <https://sites.wp.odu.edu/BORG/current-projects/temperature-and-irradiance-measurements-in-the-arctic/>
- Buoy Data from #1 and #3
- Graph paper or Excel
- Lab materials: test tubes, test tube racks, lamp or light source, thermometers, algae (purchased from biological supply or gathered from local sources), paper to cover and adjust light intensity for experiment, water, spectrophotometer, translucent colored paper for wavelength of light manipulation
- Lab guidelines student sheet (attached)

## Procedure

1. Introduce the WARMing in the Arctic Project with <https://sites.wp.odu.edu/BORG/current-projects/temperature-and-irradiance-measurements-in-the-arctic/> to the students, discuss buoy installation, location and data collection
2. Students hypothesize whether light intensity or temperature has greater significance on phytoplankton density as shown through chlorophyll A (student prior knowledge of chlorophyll pigments related to photosynthesis required)
3. Students will graph the following:  
Time versus temperature from Buoy #1 and #3  
Time versus light intensity from Buoy #3 (data is not available for light intensity from #1)
4. Students analyze graphs created from Buoy #1 and #3 with the chlorophyll graphs and discuss/write their results
5. Instructor confirms students' data indicates light intensity has a stronger impact on phytoplankton density than temperature (allow to students to derive this conclusion on their own © EXPLORE!)
6. Students design an experiment to demonstrate their findings from the graphs with light intensity with algae in test tube racks (Allow students freedom to use different paper sources for light intensity or different wavelengths of light on algae growth over time).

## Assessment

- **Performance**—Students will demonstrate understanding of light intensity impact on phytoplankton density based on chlorophyll data
- **Product**—students will produce graphs with time versus light intensity and temperature collected from the WARM data and design an experiment to compare light intensity or different wavelengths of light on algae growth
- Assessment is based on graphs made, written results/interpretation and experiment data collected

## Additional Resources

Please list any Web sites, books, publications, or other resources that would be helpful for teachers or students preparing for this lesson.