# Effect of pH on Dissolved Oxygen and Nymphaeaceae Decay

## BACKGROUND

The GLOBE Water Testing measures the water temperature, pH, dissolved oxygen, electrical conductivity, alkalinity, salinity, and nitrate. The temperature of the water can affect the pH levels by changing the rate of the ionization of water. Electrical conductivity of water is indicative of a high level of ions, which can cause water to be unsuitable for drinking or other purposes. The transparency/turbidity of the water is measured visually by the amount of light that is able to pass through the water. Alkalinity measures the amount of bases in the water that are available to neutralize acids. Nitrate in the water is a basic nutrient for the growth of plants that can limit the growth when found in limitation. The dissolved oxygen is a test of the pollution of water. The higher the concentration of dissolved oxygen, the less affected by pollution the water is. This depends on the pressure, temperature, and salinity of the water. Testing these qualities of water allows for the water to be determined to be safe or unsafe for drinking and other purposes, as well as to find how polluted that water is.

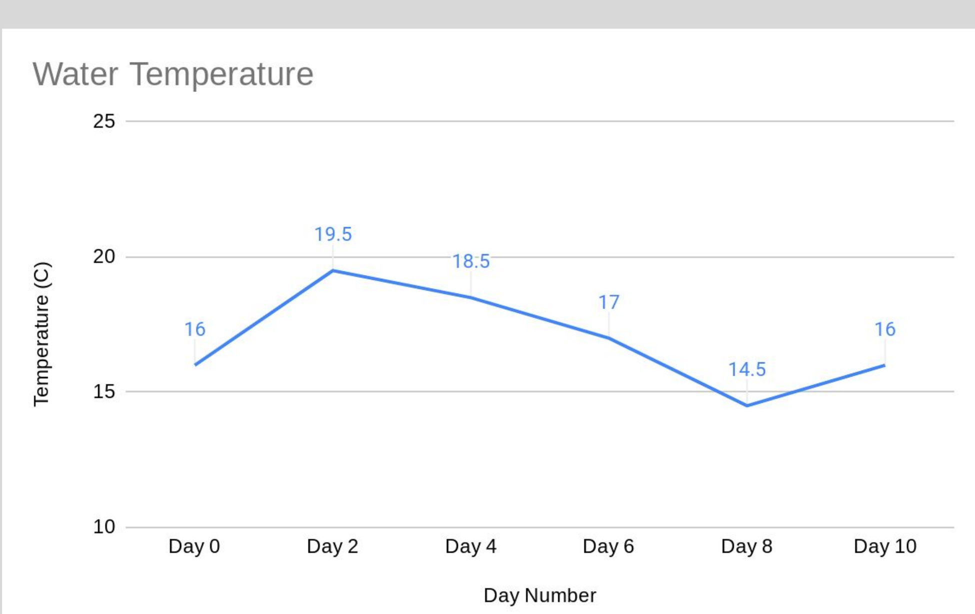
The pH of the water influences how effective the rate of photosynthesis and respiration are, and produces a bell curve with the peak being the ideal pH level of the plant.

## PURPOSE

To find how elevating and lowering the pH level of a sample of water affects the amount of dissolved oxygen present in the sample and the growth/decay of a lily pad (Nymphaeaceae) over time.

## HYPOTHESIS

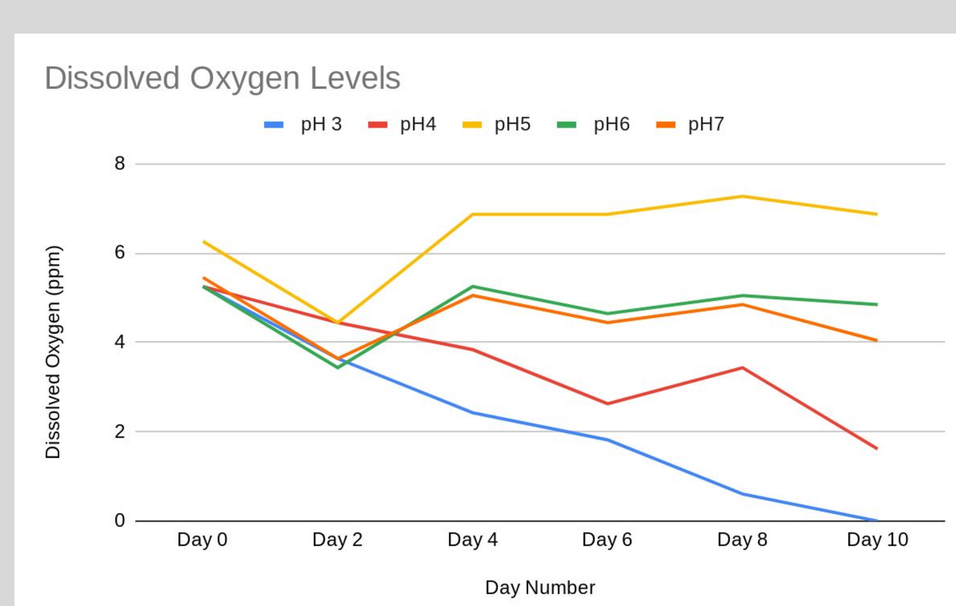
The highest overall dissolved oxygen levels will be pH 6, then pH 5, pH 4, pH 7, and, lastly, pH 3. The higher the pH, the slower the lily pad's decay will be.

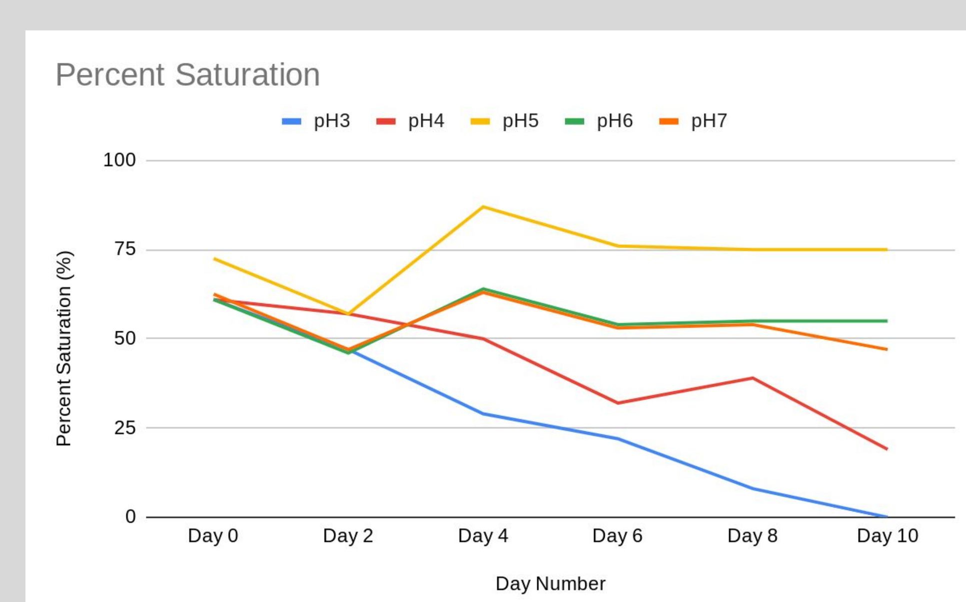



## MATERIALS AND PROCEDURES

A (1) bucket will be used to gather a large sample amount of water and (5) lily pads. The water will be distributed evenly into (5) separate containers, with a lily pad in each. The original pH of the water will be measured by litmus strip test. Then the pH of four of the containers of water will be changed, using vinegar to raise pH and sodium hydroxide to lower pH. Final pH's will include two levels lower than original (pH3), one level lower than original (pH4), original (pH5), one level higher than original (pH6), and two levels higher than original (pH7).

Dissolved oxygen tests will be performed every 2 days for 10 days. Materials are; (5) sample collection containers, Manganous Sulfate solution, Alkaline Potassium Iodide Azide, Sulfuric Acid, (5) small beakers, (1) Titrator, Sodium Thiosulfate, and Starch Indicator Solution. Procedure for testing is as follows: submerge 32.5mL container into sample and close container underwater. Remove top and add 4 drops of Manganous Sulfate solution and 4 drops of Alkaline Potassium Iodide Azide. Invert until combined and let precipitate settle toward the middle of the container. Remove top and add 4 drops of sulfuric acid. Invert gently until all precipitate is dissolved. Sample is now fixed. Add 20 mL of each sample to a corresponding small beaker. Depress the plunger, and insert into the Sodium Thiosulfate. Fill the Titrator to the 0 line. Then titrate into the beaker, swirling gently, until the sample is a pale yellow. Add 8 drops of the Starch Indicator solution to the sample. Then, titrate the Sodium Thiosulfate, swirling gently, until the sample becomes completely colorless. The amount of solution titrated is used to determine the oxygen saturation and dissolved oxygen content. Each time the dissolved oxygen is tested, the diameter of the lily pad will also be measured.




## RESULTS AND DISCUSSION

The original pH, pH 5, had the highest final dissolved oxygen level, at 6.868 ppm. pH 6 had a final 4.848 ppm dissolved oxygen level. pH 7 had the next highest final level, at 4.04 ppm. pH 4 had the final dissolved oxygen level of 1.616 ppm. The lowest final dissolved oxygen level was pH 3, with 0.0 ppm. This shows that the original pH was able to maintain the highest dissolved oxygen level. Then the pH levels directly above and below the original were the next closest, while dissolved oxygen decreased at a faster rate with the lower pH levels. pH 3 was the most acidic level and did not allow for dissolved oxygen to be maintained at all over the course of observation. Increases in dissolved oxygen could also potentially be due to photosynthesis of microorganisms living in the samples. Additionally, any mold that may have grown in the samples over time could have lowered the dissolved oxygen levels because of its own metabolic processes.

The total percent change in lily pad diameter was 3.49 for pH 7, 2.36 for pH 6, 1.01 for pH 5, 0 for pH 4, and -2.14 for pH 3. The pH 7 would be the most neutral of the samples, and would therefore theoretically have the least amount of other dissolved components. Because of this, the percent change in the lily pad diameter of this sample was the greatest, and in a positive direction. The lily pad expanded may have due to tonicity. Since the lily pad would have been in the pH 5 environment, it may have been hypertonic to the sample with the pH of 7. This may have led to osmosis to increase the turgor pressure of the lily pad. Another potential reason for the greater change in the pH7's diameter could be that this lower pH is the ideal level for the enzymes which are contained in the lily pad to perform photosynthesis.

## CONCLUSIONS

While pH 6 was predicted to have the highest dissolved oxygen levels with pH 5 having the second highest, pH 5 actually had the highest while pH 6 had the second highest. pH 4 was predicted to have the middle dissolved oxygen level and pH 7 to have the second lowest, but pH 7 actually had the middle level, and pH 4 had the second lowest. The hypothesis, was, however correct in that pH 3 had the lowest dissolved oxygen levels. Additionally, the hypothesis that the higher the pH level, the slower the lily pad decay would be was correct, as the lily pads in higher pH actually grew.