

# Ap biology photosynthesis lab answers

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**What would you predict about the density of leaves, leaf disks if the gases are removed from the spongy mesophyll and replaced with water?** The spongy mesophyll layer is normally infused with gases, oxygen and carbon dioxide. Leaves (or disks cut from leaves) will normally float in water because of these gases. If you draw the gases out from the spaces, then the leaves will sink because they become more dense than water.

**Why is O<sub>2</sub> accumulating on the disk?** As the plant leaf photosynthesizes, oxygen is produced that accumulates as oxygen gas bubbles on the outside of the leaf disk. The attached oxygen gas changes the buoyancy of the leaf disk and once enough oxygen has been produced, the leaf disk will rise to the surface of the baking soda solution.

**How the air gas is removed from the spongy mesophyll of the spinach leaf discs?** Be careful not to crush the leaf disks. Make sure they are all in the water. Close the tip and pull back on the syringe plunger to create a vacuum. Hold for 10 seconds. This process helps remove air from the spongy mesophyll layer of the leaf disks, causing them to sink in the solution.

**What is the purpose of a photosynthesis lab?** In this lab, students explore the process of photosynthesis in spinach leaves. As oxygen is produced, the density of the leaves change and they will begin floating in a sodium bicarbonate solution. The time it takes for a certain number of leaves to float can be used to calculate the rate of photosynthesis.

**How does suction help the leaf disks to sink?** This is because leaves have air in the spaces between cells, which helps them collect CO<sub>2</sub> gas from their environment

to use in photosynthesis. When you apply a gentle vacuum to the leaf disks in solution, this air is forced out and replaced with solution, causing the leaves to sink.

**Will the leaf disks float faster or slower if the experiment is adjusted to decrease the photosynthetic rate?** Floating of leaf occurs due to production of oxygen in the process of photosynthesis. The leaf discs float faster if the rate of photosynthesis is increased because oxygen production is also increased while the leaf discs float will be slower if the rate of photosynthesis is decreased due to low production of oxygen.

**Why do leaf disks sink if the same molecules of gas are consumed and produced?** During cellular respiration, plants use the sugar they produced during photosynthesis as an energy source, together with the oxygen, to create carbon dioxide and water. This means the oxygen bubbles that make the leaf disks float get consumed over time and the leaf disks sink.

**Why did you calculate the median time it took for the leaf disks to float as opposed to taking the average?** The point at which 50% of the leaf disks are floating (the median) is the point of reference for this procedure. By extrapolating from the graph, the 50% floating point is about 11.5 minutes. Using the 50% point provides a greater degree of reliability and repeatability for this procedure.

**Why do leaf disks float when exposed to light?** As oxygen is produced by photosynthesis, it comes out of solution and infiltrates the leaf tissue, replacing some of the water. This decreases the density of the disks, and they begin to float. The number of disks that float per unit of time gives a measure of the rate of photosynthesis.

**What happened to the spinach disks as they give off oxygen from photosynthesis?** As the leaves produce oxygen, bubbles forming on the surface of the disks will cause them to rise. If you remove the light source from the cup, the leaves eventually will sink.

**Why use sodium hydrogen carbonate in a photosynthesis experiment?** sodium hydrogencarbonate - formula  $\text{NaHCO}_3$  - is added to the water to supply carbon dioxide - a reactant in photosynthesis - to the plant.

**Why does sodium bicarbonate increase the rate of photosynthesis?** The purpose of adding sodium bicarbonate powder to the water increases the amount of carbon dioxide in the water. As the process of photosynthesis requires carbon dioxide, the addition of sodium bicarbonate replenishes the carbon dioxide. This increases the rate of photosynthesis and this oxygen evolved increases.

**Why don't the leaf disks soaking in water float?** Why don't the leaf disks soaking in the water (control) float? The leaf disks soaking in the water don't float because cellular respiration is occurring at the same time as photosynthesis and will consume the oxygen that has accumulated, causing the plant disks to sink.

**What is the role of the vacuum in the leaf disk?** In the floating leaf disk procedure, a vacuum is used to remove trapped air and infiltrate the interior of plant (leaf) disk samples with a solution containing bicarbonate ions that serve as a carbon source for photosynthesis.

**Do leaves release oxygen after being cut?** Here's the short answer: All leaves store water in their leaves. In the presence of light, even if the leaves are cut off, leaves can produce traces of oxygen as long as the leaf hasn't started to dry.

**Why do the leaf disks sink when evacuated with sodium bicarbonate?** When the air spaces are infiltrated with a sodium bicarbonate solution, the overall density of the leaf disks increase and they sink. Bicarbonate ion serves as the carbon source for photosynthesis.

**What does baking soda do to photosynthesis?** Additionally, baking soda can release carbon dioxide when heated, which can then be utilized by the plant for photosynthesis. However, it's important to note that while baking soda can potentially enhance photosynthetic rate under certain conditions, excessive amounts can have negative effects.

**What is the purpose of soap in photosynthesis lab?** Why did we add detergent to the solution? Detergent was added to the solution because soap breaks down molecules on the surface of the leaf so that the bicarbonate solution can easily enter into the leaf and cause the reaction to occur.

**What is the hypothesis of the floating leaf disk photosynthesis lab?**

**HYPOTHESES:** In this exercise, the experimental hypothesis is that the leaf discs will have a greater rate of photosynthesis in the bicarbonate solution, because bicarbonate provides added CO<sub>2</sub> to fuel photosynthesis, causing more leaf discs to float.

**Why do the leaf disks sink if the same molecules of gas are consumed and produced?**

Leaf disks normally float, however when the air spaces are infiltrated with carbon dioxide, the overall density of the leaf disk increases and the leaf disk sinks. When sodium bicarbonate is added to the water, the bicarbonate ion acts as a carbon source for photosynthesis causing the leaf disks to sink.

**How do you measure the rate of photosynthesis in leaf disks?**

By measuring how many leaf discs are floating at consistent intervals, we can estimate the rate of photosynthesis. While we won't be able to measure the rate at which oxygen molecules are created, the time it takes for the leaf disks to float is a much more readily observable proxy for the molar rate of the reaction.

**What product of photosynthesis causes the leaf disks to float?**

As photosynthesis occurs, oxygen is produced which fills the intercellular spaces. The decrease in density causes the leaf discs to rise and float. Observations are made as the disk cells undergo photosynthesis and students will record the time it takes for leaf disks to rise to the surface.

**How does the leaf Minimise water loss while still maintaining effective diffusion?**

Thick waxy cuticle - this minimises water loss by diffusion directly through the cells at the top of the leaves. Sunken stomata - pitted stomata minimises water loss as it reduces air movement over the stomata, creating a humid microclimate, reducing evaporation rate and the water potential gradient.

**What will happen to the leaf disks if you remove the air from the spongy mesophyll?**

The spongy mesophyll layer is normally infused with gases, oxygen and carbon dioxide. Leaves (or disks cut from leaves) will normally float in water because of these gases. If you draw the gases out from the spaces, then the leaves will sink because they become more dense than water.

**Why is spinach used in photosynthesis lab?** Spinach is a good model system due to its cheap price, accessibility, rich chloroplast content, and easiness to handle and maintain. Like all plants, spinach uses photosynthesis in order to create energy and sustain life.

**Do leaves still photosynthesize after being cut?** “The cycle of photosynthesis is about taking light and oxygen and water and turning it into starches and sugars,” Gay reminds us. “When the flower is cut, photosynthesis is much reduced.

**Why do sunken spinach leaves float when placed under white light?** Small disks of spinach, from which the air has been removed, will be sunk in two beakers of water, then one placed in the dark and one placed under a light. If photosynthesis occurs, oxygen will be produced, and the disks will float to the surface of the water.

**What causes the overall density of the leaf disk to sink in activity 2?** When the air spaces are infiltrated with a sodium bicarbonate solution, the overall density of the leaf disks increase and they sink. Bicarbonate ion serves as the carbon source for photosynthesis.

**Why do the leaf disks sink if the same molecules of gas are consumed and produced?** During cellular respiration, plants use the sugar they produced during photosynthesis as an energy source, together with the oxygen, to create carbon dioxide and water. This means the oxygen bubbles that make the leaf disks float get consumed over time and the leaf disks sink.

**What happened to the leaf discs as they gave off oxygen from photosynthesis?** As oxygen is produced by photosynthesis, it comes out of solution and infiltrates the leaf tissue, replacing some of the water. This decreases the density of the disks, and they begin to float. The number of disks that float per unit of time gives a measure of the rate of photosynthesis.

**What would be the movement of gases in and out of the leaf during light conditions?** In daylight, plants are both respiring and photosynthesizing, so oxygen and carbon dioxide are diffusing in and out of the leaves. But overnight, without sunlight, photosynthesis stops and stomata close. With just respiration taking place, only oxygen diffuses into the leaves and only carbon dioxide diffuses out.

**Why do the leaf disks sink after infiltration and rise during photosynthesis?**

When sodium bicarbonate is added to the water, the bicarbonate ion acts as a carbon source for photosynthesis causing the leaf disks to sink. As photosynthesis proceeds, oxygen is released into the interior of the leaf, which changes its buoyancy causing the disk to rise.

**Why did you calculate the median time it took for the leaf disks to float as opposed to taking the average?**

The point at which 50% of the leaf disks are floating (the median) is the point of reference for this procedure. By extrapolating from the graph, the 50% floating point is about 11.5 minutes. Using the 50% point provides a greater degree of reliability and repeatability for this procedure.

**What does it mean when the leaf discs float to the surface after being submerged?**

In the light, you should expect to see the disks in the control solution (water) stay on the bottom, but the disks in the treatment solution (baking soda) should begin to rise as they use the CO<sub>2</sub> to undergo photosynthesis and produce oxygen bubbles. The bubbles should cause the disks to float.

**What is the independent variable in the floating leaf disk photosynthesis lab?**

The light treatment in our experiment was our independent variable. All other variables were the same. The dependent variable was the floating of the discs. Our control was the experiment with no light.

**Why does a leaf carrying out photosynthesis inevitably lose water to the air?**

When stomata open for carbon dioxide uptake, water vapor also escapes through the stomata into the atmosphere. This water loss during photosynthesis is known as "transpiration pull," and it helps maintain the flow of water from the roots to the leaves, sustaining the cohesion-tension mechanism in the xylem.

**Why do the leaf disks in the baking soda solution begin to float?**

The leaf disks intake carbon dioxide from a baking soda solution and sink to the bottom of a cup of water. When exposed to light, the disks use carbon dioxide and water to produce oxygen and glucose. Oxygen released from the leaves forms tiny bubbles that cause the leaves to float.

**Why was it necessary to use the syringe on the leaf disks?** Carbon dioxide is one of the reactants required for photosynthesis to occur. c. Exposing the disks to a vacuum in the syringe: The purpose of exposing the disks to a vacuum in the syringe is to remove the air from the intercellular spaces of the leaf discs.

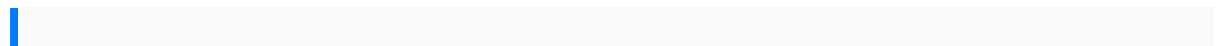
**Why did the leaf disks need to be placed upside down in the water?** Floating the leaves upside down (stomatal side up) should allow maximum carbon dioxide entry.

**Where did the leaf disks get the CO<sub>2</sub> needed for photosynthesis?** The baking soda provides the carbon dioxide that the leaf needs for photosynthesis. The leaf disks are then sunk in the baking soda solution and exposed to light. As the plant leaf photosynthesizes, oxygen is produced that accumulates as oxygen gas bubbles on the outside of the leaf disk.

**Which plant organ absorbs the most light for photosynthesis?** Leaves are the main (but not only) organ responsible for turning sunlight into food. The green pigment found in most leaves absorbs sunlight, which is one of the important ingredients in the food-making process.

**Why are stomata on the bottom of the leaf?** If more stomatal pores are present on the upper side, due to high rate of evaporation from the upper epidermal layer, the water present in the plant gets evaporated and the amount of water in plants get reduced. So in order to prevent this, more stomata are present in the lower epidermis than in the upper epidermis.

**What controls the opening and closing of stomata?** A pair of guard cells surrounds each stoma, and these cells control the opening and closing of the stomatal pore between them.



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