Float-O-Synthesis

Rate of Photosynthesis Lab

Background Information

Photosynthesis is the process that autotrophs use to convert light energy into chemical energy in the form of carbohydrates. The photosynthesis reaction combines carbon dioxide with hydrogen from water, resulting in glucose and oxygen.

When submerged in water, leaf discs will float because the oxygen formed through photosynthesis fills the cellular spaces. However, if oxygen is removed from the cellular spaces and replaced with water, the leaf discs will sink under the weight of the water. As photosynthesis continues, the oxygen will begin displacing the water, changing the buoyancy of the leaf discs and causing them to rise to the top of the water.

Materials

- Water
- 10cc Plastic Syringe
- Fresh Spinach Leaves
- Plastic Straw
- Timer
- Light Source
- Sodium Bicarbonate (Baking Soda)
- Dish Soap

Pre-Lab Questions

1. Read through the lab procedure. In the table below, fill in the independent and dependent variables and the control group for this experiment.

Independent Variable	
Dependent Variable	
Control Group	

Procedure

Preparing the Leaf Discs

1. Cut ten leaf discs from the spinach leaves, using the straw. Be sure not to cut the vein of the leaf, but instead take your discs from the leaf blade.
2. Remove the plunger from the syringe. Add the ten leaf discs to the syringe and replace the plunger. Be sure that your leaf discs are near the tip of the syringe, to avoid squishing them.
3. Create a 0.2% sodium bicarbonate solution by mixing 300 mL of water with ⅛ teaspoon of baking soda. The baking soda will provide the source of carbon necessary for photosynthesis to occur.
4. Add one drop of dish soap and stir gently, but do not make suds! The dish soap will help the leaf discs attract the carbon from the baking soda.

5. Insert the tip of the syringe into the water & sodium bicarbonate solution and draw up 8 mL into the syringe. The leaf discs should be floating at this time.
6. Hold the syringe tip upward and expel air by pressing the plunger carefully. Do not squish the discs!
7. Seal the tip of the syringe with your finger. Pull back on the plunger using your other hand, creating a vacuum within the syringe. It should be difficult to pull the plunger and you might see bubbles coming from the leaf discs.
8. At the same time, release the plunger and remove your finger from the tip of the syringe. Some of the discs should start to sink. Tap the edge of the syringe to dislodge bubbles on the edges of the discs.
9. Repeat steps 7 and 8 until all discs sink to the bottom of the syringe. Do not overdo it- this can damage the cells of the leaf disc.

Setting Up the Experiment

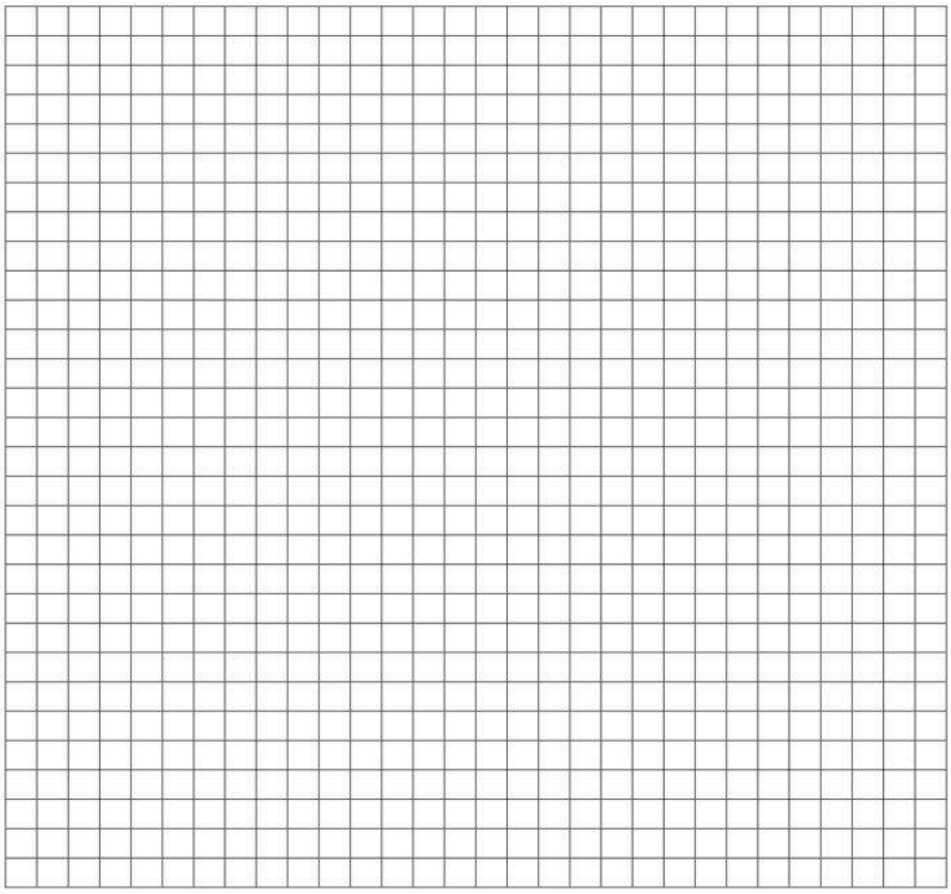
10. Pour the solution and leaf discs into a clear cup or beaker. Add about ¼ cup of the sodium bicarbonate solution and place this directly in front of the light source.
11. Repeat steps 1-10, setting this control group up in a dark place (such as a cabinet).
12. Start the timer. At the end of each minute, record the number of leaf discs floating in each cup. Continue making observations for 15 minutes or until all leaf discs have begun to float.

Data Collection

Use the table below to record your results.

	Time (minutes)															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Group: Dark																
Group: Light																
Class Average: Dark																
Class Average: Light																

On the following page, use the data table above to graph your group's light and dark data. Don't forget to include a title and axis labels.



Post- Lab Questions

1. In general, what pattern(s) did you notice when analyzing your results of this experiment? What does this mean in relation to photosynthesis?

2. Explain the role that the gasses produced through photosynthesis play in changing the buoyancy of the leaf discs in this experiment.

3. There are many variables that impact the rate of photosynthesis that we could change in this experiment. Choose one variable that we could change and explain how you could design an experiment to test it.