Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*This is an observation lab, so we do not have a question or hypothesis.*

P. \_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Photosynthesis in Leaf Disks**

Objectives: By the end of this activity you should be able to:

• Describe the **reactants** and **products** of photosynthesis and the source of reactants from the environment *(Where do the plants get what they need to go through photosynthesis?)*

• Explain the relationship of photosynthesis to the observations made during the experiment.

*(What did this experiment have to do with photosynthesis?)*

Background:

* Photosynthesis is the process by which plants capture light energy from the sun and turn it into glucose (C6H12O6).
* To make glucose, sunlight is captured in pigments like chlorophyll, the substance that gives leaves their green color and is found in the chloroplast.
* The sun’s energy is passed through a chain of events that breaks up the molecules of water (H2O) and carbon dioxide (CO2 ) and rebuilds molecules of oxygen (O2) and glucose (C6H12O6).

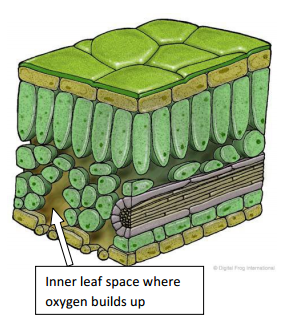
Overall reaction**: 6CO2 + 6H2O + light energy  C6H12O6 + 6O2**

***REACTANTS******PRODUCTS***

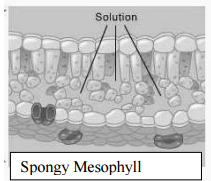
Materials:

• 1/3 plastic spoon of (1.5 g) sodium bicarbonate (baking soda)

• Liquid dish soap – 1 drop



• Plastic syringe (10 mL)—no needle!



• stirring stick

• Leaf material

• Hole punch

• 250 mL beaker

• tweezers

• Clock with second hand

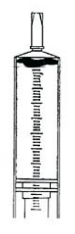
• Light source

• Paper towels

* In this lab, we are exploring the process of photosynthesis in spinach leaves. As oxygen is produced, the density of the leaf will change and it will begin to float in a sodium bicarbonate solution.
* We are adding CO2 to the spaces in the spongy mesophyll of leaf disks by filling them with a sodium bicarbonate (baking soda) solution. This baking soda solution adds CO2 to the water to stimulate (to start) photosynthesis.
* As this solution enters the leaf spaces and forces the O2 out, the disks will sink in the solution.
* The leaf disks are then exposed to light, and we will observe photosynthesis take place in the leaf. As photosynthesis takes place in the leaf disk, tiny oxygen bubbles will push out the solution from the leaf spaces and make the leaf disks light enough to rise.

Procedure: Solutions are safe to handle without gloves.

1. Using a one-hole punch, cut 10 leaf disks from baby spinach—pick the darkest green leaves.
2. Add 150 mL water to the beaker.
3. Add about 1/4 to 1/3 of the PLASTIC SPOON of baking soda to the beaker.
4. Stir **WITH THE STIRRING STICK** until dissolved.
5. Add **one** small drop of liquid soap to the beaker—this will wet the waxy surface of the spinach leaf so that the baking soda solution can get inside the leaf.
6. Stir a **few** times gently—you do not want to create bubbles.
7. Remove the plunger from a large clean syringe (no needle).
8. Place 10 leaf disks into the body of the syringe. Be sure the leaf disks are near the tip of the syringe. Gently move any stuck leaf disks with the tweezers to the end of the syringe.

A.

1. Reinsert the plunger so as not to damage the leaf disks---have the end

of the plunger close to the tip of the syringe but do not squish the leaf disks.

Discs floating on top

1. Insert the tip of the syringe into a beaker baking soda solution beaker

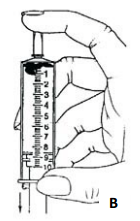
and draw 3-4 mL into the syringe. (A) The leaf disks should be floating at this time.

1. Hold the syringe tip upward and expel the air by depressing the plunger carefully.

Stop before solution comes out the tip—if a little solution comes out—it’s okay.

1. Seal the tip of the syringe using the index finger of your left hand and hold tightly.

Pull back on the plunger creating a partial vacuum within the syringe. If you have a good seal it should be hard to pull on the plunger and you should see bubbles coming from the edge of the leaf disks. Hold for a count of ten. (B) Simultaneously, release your index finger and the plunger. Some of the leaf disks should start to sink. Tap the side of the tube or shake gently to break any bubbles on the edges of the disks.



1. Repeat steps 11 and 12, about 3 times, until all the disks sink. Do not overdo these steps!! You have been successful if the disks sink to the bottom. Don't repeat "just to be sure" as it is possible to damage the cells of the leaves.
2. Remove the plunger from the syringe and pour the solution containing the disks into the baking soda beaker. Make sure they sink to the bottom.
3. Begin timing the experiment as soon as the light is turned on.
4. Record your observations on the data table.
5. Notice what is happening to the leaf disks as photosynthesis proceeds. Continue to record your observations on the data table.
6. After each time check, tap the side of the beaker to make sure the disks are not “sticking” to the container walls.

|  |  |
| --- | --- |
| Time (minutes) | # of leaf disks that floated up during each minute |
| 1 |  |
| 2 |  |
| 3 | |  |  | | --- | --- | | Time (minutes) | # of leaf disks that floated up during each minute | | 13 |  | | 14 |  | | 15 |  | | 16 |  | | 17 |  | | 18 |  | | 19 |  | | 20 |  | | 21 |  | | 22 |  | | 23 |  | | 24 |  | |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 |  |
| 12 |  |

Lab Analysis and Questions:

1. Where in the environment do plants get the reactants for photosynthesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Why was detergent added to the solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Why was baking soda added to the solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the equation for photosynthesis.

\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_ + light energy \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_

Reactants Products

1. What was the product that we observed in this lab.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Explain what happened to make the leaf discs rise to the surface.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Do you think the leaf disks would rise to the surface if the beaker and disks were placed in the dark?\_\_\_\_\_\_\_
2. Explain your answer to #7. Above. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_