

Photosynthesis in Leaf Discs

(created by the Arkansas Department of Education; edited by Dr. Crowther)

Lab materials (per group of 3-4 students)

- fresh leaves (e.g., spinach)
- access to one-hole punch
- 0.5% solution of sodium bicarbonate (NaHCO_3 ; baking soda; 0.5 g per 100 mL) with a small amount of liquid dishwashing detergent (~1 drop per 100 mL)
 - The sodium bicarbonate is the leaf's source of carbon dioxide (CO_2).
 - The detergent breaks down the leaves' waxy coating (cuticle) so that compounds can get into and out of the leaves more easily.
- spoon
- plastic 10-mL syringe
- 2 beakers (100-250 mL each)
- light source (60-watt bulb or higher) with extension cord

Procedure

1. Using a one-hole punch, cut 20 leaf discs from leaves.
2. Remove the plunger from a large clean syringe (no needle). Place 20 leaf discs into the body of the syringe. Be sure the leaf discs are near the tip of the syringe as you reinsert the plunger so as not to damage the discs.
3. Insert the tip of the syringe into a beaker of 0.5% sodium bicarbonate solution and draw 7-8 mL into the syringe. The leaf discs should be floating at this time.
4. Point the syringe tip upward. Expel the air by depressing the plunger carefully. Stop before the solution comes out the tip.
5. Seal the tip of the syringe with the index finger of your left hand. 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 discs. Hold for a count of ten.
6. Simultaneously release your index finger and the plunger. Some of the leaf discs should start to sink. Tap the side of the tube or shake gently to break any bubbles.
7. Repeat steps 4-6 until all of the discs sink.
8. Remove the plunger from the syringe and pour the solution containing the discs into 2 beakers. There should be 10 discs per beaker; make sure they sink to the bottom. Add 100 mL of additional solution to each beaker.
9. Cover one of the beakers to prevent light from reaching the leaf discs. Place the second beaker under a light source, approximately 15 centimeters from the light. Begin timing the experiment as soon as the light is turned on. **Safety note: be careful of the hot lights and extension cords (a tripping hazard)!**
10. Notice what is happening to the leaf discs as photosynthesis proceeds. Record your observations in the Data Table. After each time check, tap the side of the beaker to make sure the discs are not sticking to the wall. Check the covered beaker quickly to minimize light exposure.
11. The experiment is over after 15 minutes. Dump all liquids in the sink. Rinse syringes and beakers.

Name:

Date:

Assignment: Photosynthesis in Leaf Discs

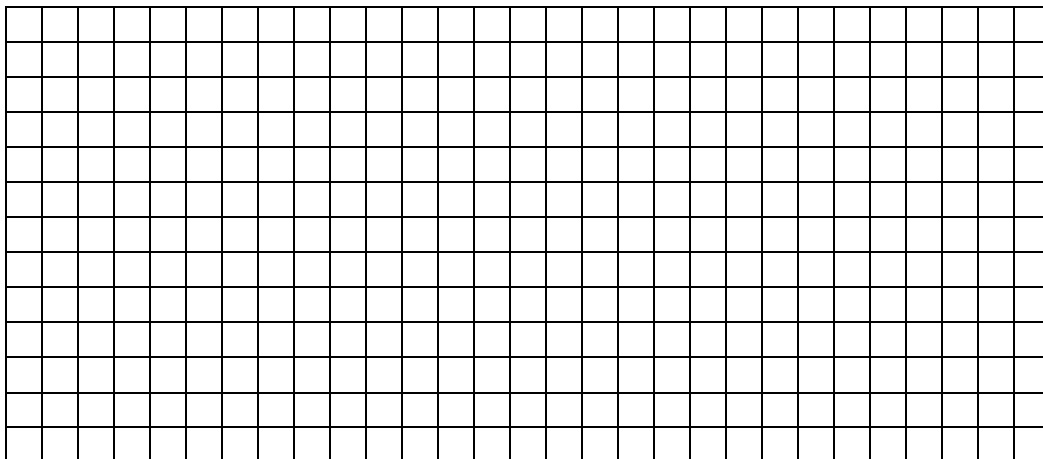
LO: Analyze & interpret data.

SLE: Complete complex tasks successfully.

Data Table: Number of Leaf Discs Floating

Time (minutes)	Number of discs floating (Light)	Number of discs floating (Dark)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

In the area below, create a double line graph to display the results of the experiment. Label the X and Y axes, provide a title, and label each line appropriately or use a color key.



Lab Analysis and Questions

1. (a) What is the independent variable in this experiment?
 (b) What is the dependent variable?
2. Why was sodium bicarbonate (NaHCO_3) added to the solution?
3. Why was detergent added to the solution?
4. Explain why it was important to keep one beaker covered during the experiment.
5. Describe the relationship between the number of discs floating and time, as shown on the graph.
6. Did any leaf discs float in the dark beaker? If so, what might explain this result?
7. Explain the changes that occurred within the leaf tissue that allowed the leaf discs to rise to the surface.
8. Imagine that you had 1-2 additional class periods available for follow-up experiments with a setup similar to this one. Propose another experiment that you could do to test the effect of another factor (other than light) on photosynthesis.
 - (a) Question:
 - (b) Hypothesis (with reason):
 - (c) Outline of procedure for testing hypothesis: