

The Rising Disks: What Makes a Sunken Leaf Float?

Investigation question: Leaf disks that have been made to sink rise again in some cups but not others. What is being made inside the leaf, and which inputs does the leaf need to make it?

Evidence-based mystery

Groups of 4

1 session

Setup 10 · Activity 35 · Cleanup 5 min

MS-LS1-6 · assesses

MS-LS2-3 · supports

Name _____

Group _____

Date _____

Your role today

- ☐ **Preparer:** Punches the leaf disks away from the veins, mixes the baking soda solution and the plain-water control, and labels the three cups.
- ☐ **Syringe operator:** Loads disks and solution into the syringe, pulls the vacuum to sink the disks, and pours each batch into its cup without foam.
- ☐ **Timer and counter:** Starts the timer when the cups go under the lamp, calls out the number of floating disks in each cup every minute, and lifts the dark cover only for the count.
- ☐ **Recorder:** Writes every count in the table, flags anything unexpected, and plots the three cups on the graph as the data come in.

Safety

- Syringes have no needles and must never be fitted with one. Pull the plunger gently; a hard pull can pop it out and spray solution.
- Keep lamps and cords away from water. Place cups on a tray. If a lamp uses an incandescent bulb it gets hot: keep hands off the bulb and the cup at least 30 cm away so the water does not warm, which would change the result.
- Baking soda solution is harmless on skin but stings eyes; rinse with water if splashed. Do not eat the spinach or drink any solution used in the lab.
- Hole punches pinch; keep fingers clear of the jaws. Wipe spills at once so the floor does not get slippery.

Procedure

1. Label three cups: A (light, baking soda), B (dark, baking soda), C (light, plain water). Pour the bicarbonate solution into A and B and plain soapy water into C, each about 3 cm deep.
2. Punch 30 leaf disks, avoiding the thick veins. Keep them in a damp paper towel so they do not dry out. You will use 10 per cup.
3. Remove the plunger from the syringe, drop 10 disks in, replace the plunger and draw up about 5 mL of the liquid from cup A. Hold the syringe tip up, tap it, and push out the air at the top.

4. Cover the tip firmly with a finger and pull the plunger back to about the 10 mL mark. Hold for 10 seconds. You are lowering the pressure so the air inside the leaf's spaces bubbles out and liquid moves in. Release, then repeat two or three times until all the disks sink when the syringe is tilted.
5. Gently push the disks and liquid into cup A so they settle on the bottom. Repeat steps 3 to 5 for cup B using cup B's solution, and for cup C using plain soapy water. If a disk refuses to sink after four pulls, set it aside and note it.
6. Place cups A and C under the lamp side by side at the same distance from the bulb. Place cup B under the lamp too, but cover it with the box or foil tent so no light reaches it. Start the timer at the moment the light reaches cup A.
7. Every minute for 20 minutes, count the disks floating at the surface of each cup and record the number. For cup B, lift the cover only long enough to count, then re-cover. A disk counts as floating when any part of it has left the bottom.
8. After the 20-minute count, if cup A has floating disks, move cup A into the dark box, keep timing, and count every 2 minutes for 10 more minutes. Record what the disks do.
9. Plot the counts for A, B and C on the same graph with three different symbols. Mark the minute at which five of the ten disks were floating in any cup that reached five.
10. Answer the recording-sheet questions as a group, then the analysis questions individually.

Record your observations

Lab 1 recording sheet: The rising disks

Record the number of disks floating in each cup at every minute. Cup A is lit with baking soda; cup B is dark with baking soda; cup C is lit with plain water. Start the timer when the lamp first reaches cup A.

Floating disks per minute (10 disks in each cup)

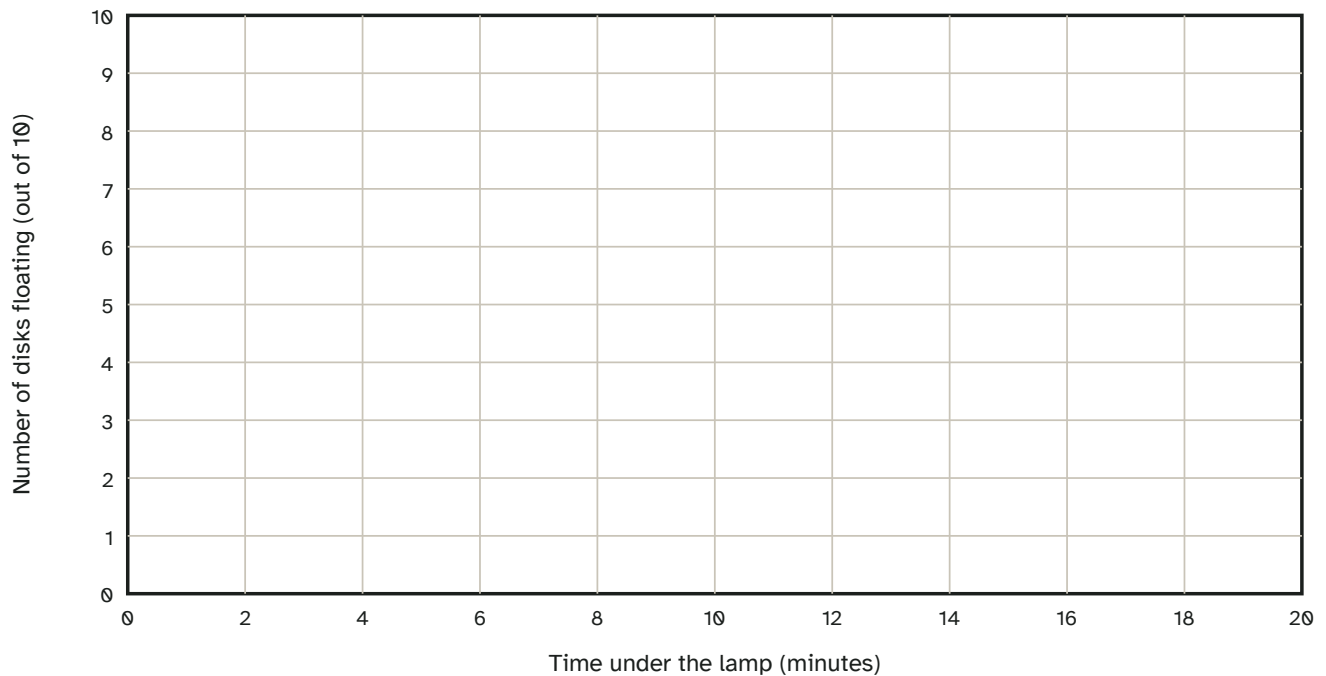
Minute	Cup A: light + baking soda	Cup B: dark + baking soda	Cup C: light + plain water	Notes
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				

Minute	Cup A: light + baking soda	Cup B: dark + baking soda	Cup C: light + plain water	Notes
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

After 20 minutes: cup A moved into the dark

Minutes in the dark	Disks still floating in cup A	What you see
0		
2		
4		
6		
8		
10		

Floating disks over time in cups A, B and C



-  Draw one leaf disk at minute 0 (on the bottom) and the same disk when it is floating. Show where the gas is and label where you think it came from.

1. Which cup had the first floating disk, and at what minute? At what minute (if ever) were five disks floating in each cup?

2. Before you read any explanation: what do you think the disks are filling with, and why do you think that?

Analysis questions

3. Compare cup A with cup B. The only difference was light. What does that comparison tell you about what the leaf needs to make the gas?

4. Compare cup A with cup C. The only difference was the baking soda, which supplies carbon dioxide to the water. What does that comparison tell you?

5. The photosynthesis equation is carbon dioxide + water + light energy → sugar + oxygen. Which product could be the gas that lifted the disks, and why can it not be the sugar?

6. When cup A was moved into the dark, what happened to the floating disks over the next 10 minutes? Explain it using the fact that plant cells use oxygen to break down sugar at all times.

- 7.** Van Helmont's willow gained about 74 kg while its soil lost about 60 g. Using your results, write a three-sentence explanation of where the willow's matter came from and what the Sun contributed.

- 8.** Describe one change to this investigation that would let you test whether the amount of light matters, and say what you would measure.
