Oxygen in the Jars

Use investigation data to explain two plant processes

BOT.1.7 "Conduct investigations, collect and analyze data, and communicate results that explain the processes of photosynthesis and cellular respiration (e.g., light intensity, light color, light distance, temperature, altering pH…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what students kept the same, circle the oxygen readings in the table, and write 1 beside the sentence about photosynthesis and 2 beside the sentence about respiration.

What Changed the Oxygen?

1 A biology class tested how light intensity affects an aquatic plant, Elodea. Four completely filled, sealed jars held equal masses of plant in equal volumes of water with bicarbonate, a source of dissolved carbon dioxide. Students kept temperature and light color constant wherever lamps were on. They changed brightness, measured in lux, and recorded dissolved oxygen initially.

2 After 30 minutes, students measured oxygen again. The table shows readings in milligrams of oxygen per liter of water (mg/L). An increase means the water gained oxygen overall; a decrease means it lost oxygen overall. Since the jars were filled and sealed, oxygen could not enter from the surrounding air.

DISSOLVED OXYGEN IN ELODEA JARS

Light (lux)	Start (mg/L)	After 30 min (mg/L)
0	8.0	7.8
200	8.0	8.1
600	8.0	8.3
1200	8.0	8.5

3 Plants use light to make sugars from carbon dioxide and water during photosynthesis, releasing oxygen. Their cells also use oxygen to break down sugars during cellular respiration, even in darkness. Each oxygen reading shows the net effect of both processes, not either rate alone. The dark jar provides a comparison when photosynthesis stops but respiration continues.

2 ANSWER WITH EVIDENCE

Use the passage

1. Calculate the oxygen change in the dark jar and in the brightest jar. Include units.

2. What does the dark jar's oxygen change suggest about cellular respiration? Explain.

3. Name two conditions the students kept the same. Why did they keep these conditions the same?

4. Does the brightest jar's oxygen gain measure photosynthesis alone? Use both plant processes in your explanation.

3 YOUR TURN

Your own words

Design a follow-up test of how dissolved carbon dioxide affects net oxygen change in Elodea. In four sentences, describe three carbon dioxide levels, at least two conditions you would keep the same, when you would measure oxygen, and how you would interpret the changes using both plant processes.

ANSWER KEY

Oxygen in the Jars

PART 1 · READ AND MARK

Underline what students kept the same, circle the oxygen readings in the table, and write 1 beside the sentence about photosynthesis and 2 beside the sentence about respiration. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Calculate the oxygen change in the dark jar and in the brightest jar. Include units.	**The dark jar lost 0.2 mg/L of oxygen; the 1200-lux jar gained 0.5 mg/L.**
2	What does the dark jar's oxygen change suggest about cellular respiration? Explain.	**Respiration continued in the dark and used oxygen, while photosynthesis stopped.**
3	Name two conditions the students kept the same. Why did they keep these conditions the same?	**Accept two of plant mass, water volume, bicarbonate availability, temperature, or light color where lamps were on. Holding them constant helps isolate the effect of brightness.**
4	Does the brightest jar's oxygen gain measure photosynthesis alone? Use both plant processes in your explanation.	**No. The gain is the net effect of oxygen released by photosynthesis and oxygen used by respiration.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would use Elodea jars with low, medium, and high levels of dissolved carbon dioxide. I would keep plant mass, water volume, lamp brightness, and temperature the same. I would measure dissolved oxygen at the start and after 30 minutes, then calculate each change. If oxygen rises in a jar, photosynthesis released more oxygen than respiration used there; comparing the changes would show how carbon dioxide affected that balance.

For the open task, accept any workable three-level carbon dioxide test with controlled conditions, two timed oxygen measurements, and an interpretation of net oxygen change. Students should not describe the net change as a direct measure of photosynthesis alone.