Unit 4: Photosynthesis & Cellular Respiration

INTRODUCTION / OBJECTIVE / SCIENTIFIC QUESTION

Write one short paragraph explaining: Plants (autotrophs) make glucose and release O_2 during photosynthesis; fish (heterotrophs) use glucose to make ATP during cellular respiration

Objective: Determine how light intensity (%) changes net O_2 (mg/L) over 60 minutes.

Scientific question: "How does increasing light intensity affect net dissolved oxygen in a tank with constant numbers of plants and fish?"

HYPOTHESIS

State what you predict will happen to ΔO_2 as light increases and where the compensation point will occur.

MATERIALS

Cell Energy simulation (web), computer or tablet with internet, paper or spreadsheet for the table, graphing tool, and ability to take a screenshot.

PROCEDURE

Keep these constants for every trial: Fish = 3, Plants = 2, Temperature = 25 °C, Light Color = White. Only Light Intensity (%) changes.

1. Set Light Intensity to the target value: 0, 20, 40, 60, 80, 100 (six trials).

2. Confirm constants (Fish 3, Plants 2, Temp 25 °C, Light Color White).

3. Click Run Simulation. The graph shows Dissolved Oxygen (mg/L) from 0 to 60 minutes.

4. Read O_2 at 0 min (start) and O_2 at 60 min (end) from the y-axis.

5. Compute ΔO_2 (mg/L) using:

$\Delta O_2 = O_2(60\ \text{min}) - O_2(0\ \text{min})$

6. Record values to the nearest 0.1 mg/L.

7. Repeat Steps 1–6 for all light levels.

8. Take one screenshot showing the sliders (Fish 3, Plants 2, Temp 25, White) and the graph with your final trial.

DATA/RESULTS

Paste the filled table and your graph here.

Data Table:

Fish	Plants	Temp (°C)	Light Color	Light (%)	O_2 at 0 min (mg/L)	O_2 at 60 min (mg/L)	ΔO_2 (mg/L)	Net process (P > R or R > P)
3	2	25	White	0				
3	2	25	White	20				
3	2	25	White	40				
3	2	25	White	60				
3	2	25	White	80				
3	2	25	White	100				

Graph:

x-axis = Light Intensity (%);

y-axis = ΔO_2 (mg/L).

Title: "Net O_2 after 60 minutes vs Light Intensity." Mark (or state) your compensation point where $\Delta O_2 \approx 0$.

ANALYSIS

In a short paragraph, describe the pattern in your graph. Identify the range where ΔO_2 is negative (respiration > photosynthesis), the point where it becomes ~0 (compensation), and where it is positive (photosynthesis > respiration).

REFLECTION QUESTIONS

1. Name the autotroph and heterotroph in this tank and state how each uses glucose.

2. Using your data, where is your light compensation point and what does it mean biologically?

Conclusion

Write three concise sentences that:

1. Restate the research question and hypothesis.

2. Summarize your main result, including the specific ΔO_2 values.

3. Explain how this result relates to energy flow (light → glucose → ATP) and the concept of the compensation point.

REFERENCES

Biology Simulations. Cell Energy
Your class text or notes on photosynthesis and cellular respiration (glycolysis, Krebs cycle, ETC).

Submission notes

- Submit one PDF containing: A fully formatted lab report that has the above sections with your completed table, one graph, answers and one screenshot of the sim settings.
- Do not change constants (Fish 3, Plants 2, Temp 25 °C, White). Only change Light Intensity (%).
- Report O_2 values to 0.1 mg/L and show your ΔO_2 calculation.