Name _____ Block _____

Investigating Photosynthesis

Background: Plants perform both cellular respiration and photosynthesis, while animals only perform cellular respiration. Plants use photosynthesis to create the glucose they need, but they must also perform cellular respiration to break this glucose down into ATP energy that their cells can use. In this simulation, you can test the effects of several factors on dissolved oxygen in a closed aquatic environment. The simulation measures changes to dissolved oxygen levels (mg/L) over 60 minutes. Dissolved oxygen is how much oxygen is available in the water for animals to use.

Pre-Lab Questions:

How do you think cellular respiration will affect oxygen levels in an aquatic environment?

How do you think photosynthesis affects dissolved oxygen levels in an aquatic environment?

Part 1: Respiration

Find the respiration for the plant.

1. Set the fish number to 0 and the plant number to 1.
2. Set the light intensity to 0% (With no light, there will be no photosynthesis and all changes to oxygen will be due to respiration).
3. Leave the other variables at the default values (25 degrees, white light)
4. Run the simulation three times, recording the starting and ending oxygen values in table 1 below.
5. Find the average difference to determine the respiration per hour.

Table 1

Trial	DO Start	DO End	DO Difference
1			
2			
3			
Average			

Average DO Difference = Respiration / hour

Average Respiration Rate / hour=	

Part 2: Light Intensity

How do you think higher or lower light intensity will affect oxygen production in aquatic plants?

_____

1. Set the fish number to 0 and the plant number to 5. Leave the other variables at the default values (25 degrees, white light).

2. Set the light intensity to 100%.

3. Record the starting and ending dissolved oxygen (D.O) values in Table 2 below by **hovering over the line on the graph**. (Numbers should be written up to 2 places after the decimal. ie. 7.08)

4. Repeat steps 3 and 4 for 80%, 60%, 40%, and 20%.

5. Calculate and record the D.O. difference. (D.O. Difference = D.O. End – D.O. Start).

Table 2.

Light Intensity (%)	D.O. Start	D.O. End	D.O. Difference
100			
80			
60			
40			
20			

Was your original hypothesis for light intensity correct?

How might plants in low intensity light ecosystems adapt to their environment?

_____

_____

_____

Part 3: Light Color

What color of light (ROYGBIV) do you think will be best for oxygen production in aquatic plants?

_____

1. Set the fish number to 0 and the plant number to 5. Leave the other variables at the default values (100% light intensity, 25 degrees).

2. Set the light color to white (the combination of all wavelengths/colors).

3. Record the starting and ending dissolved oxygen values in Table 3 below.

4. Repeat steps 3 and 4 for violet, blue, green, yellow, orange, and red light.

5. Calculate and record the D.O. difference.

Table 3.

Light Color	D.O. Start	D.O. End	D.O. Difference
White			
Violet (400nm)			
Blue (465 nm)			
Green (530 nm)			
Yellow (590 nm)			
Orange (620 nm)			
Red (665 nm)			

What do your results suggest is the best light COLOR for photosynthesis to occur? _____

Is this color natural in ecosystems? YES or NO

What would be the best light color that naturally occurs? (Meaning, what was the second-best result from your chart?) _____

What is the worst light color for photosynthesis to occur? _____

Part 4: Temperature

How do you think different temperatures will affect oxygen production in aquatic plants? Be specific.

_____

1. Set the fish number to 0 and the plant number to 5. Leave the other variables at the default values (100% light intensity, white light).

2. Set the temperature to 15 degrees.

3. Record the starting and ending dissolved oxygen values in Table 4 below.

4. Repeat steps 3 and 4 for 20, 25, 30, and 35 degrees.

5. Calculate and record the D.O. difference.

Table 4.

Temperature (C)	D.O. Start	D.O. End	D.O. Difference
15			
20			
25			
30			
35			

Analysis Question:

What is the optimum temperature, light intensity, and wavelength for the process of photosynthesis to occur? (Meaning, what was the highest number for D.O. Difference in each category except light color?)

Temperature _____ Light Intensity _____ Light Color _____

Conditions are not optimal for photosynthesis to occur in every ecosystem. What do you think this indicates about different plants and the structures they use for photosynthesis? (Give specific examples)

_____

_____

_____

_____