OPHS Biology

Name: _____

Date: _____

Unit 4: Cell Energy

Topic 1: ATP & Photosynthesis

This handout allows you to explore factors that may influence the rate of photosynthesis. You will be analyzing some graphs, completing some, and answering related questions along the way. You will begin by responding to general questions about the process of photosynthesis.

1. What is photosynthesis? _____

_____

2. What organisms carry out photosynthesis? _____
3. How do the following reactants enter cells for the process of photosynthesis?
   - Trace the path of water from the roots to the cells within the leaves:

     _____
     - *What property (or properties) of water allow it to "climb against gravity?":*

       _____
   - How does carbon dioxide enter the leaf and make its way to the photosynthetic cells?

     _____
   - What is the source of energy that is required for photosynthesis? _____
4. What do organisms that carry out photosynthesis produce (products)? _____
5. What is the formula for photosynthesis? _____

Use the following data tables to create or analyze graphs of the effect of different variables on the rate of photosynthesis. For all graphs, plot photosynthetic rate on the y-axis – it is the dependent variable. Do your best to use the entire graph. Label the axes and provide units for each variable.

Table 1: The effect of light on the rate of photosynthesis.

Light Intensity (angstroms)	Rate of Photosynthesis (O_2 ppt/min)
0	0
500	58
1000	89
1500	99
2000	106

The effect of _____ on the _____

Based on the graph above, write a complete sentence that summarizes the relationship between light and rate of photosynthesis. *Be specific in describing the SHAPE of your graph.

Table 2: The effect of carbon dioxide concentration on the rate of photosynthesis.

Carbon Dioxide Concentration	Photosynthetic Rate (O_2 ppt/min)
2 %	70
4 %	93
6 %	120
8 %	120

The effect of _____ on the _____

Based on the graph above, write a complete sentence that summarizes the relationship between CO_2 and rate of P.S. *Be specific in describing the SHAPE of your graph.

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Table 3: The effect of water on the rate of photosynthesis. Light intensity = 1500

Water Intake Rate	Stomatal Opening Factor*	Photosynthetic Rate (O_2 ppt/min)
0.00	0.10	0
0.05	0.69	20
0.30	1.00	106
1.00	1.00	106

The effect of _____ on the _____

Based on the graph above, write a complete sentence that summarizes the relationship between water and rate of photosynthesis. *Be specific in describing the SHAPE of your graph.

Table 4: The effect of temperature on the rate of photosynthesis.

Temperature	Photosynthetic Rate (O_2 ppt/min)
5° C	11
15° C	84
25° C	106
35° C	84
45° C	11

The effect of _____ on the _____

Based on the graph above, write a sentence that sums up the relationship between temp and rate of P.S.
*Be specific in describing the SHAPE of your graph

OPTIMAL TEMP FOR P.S.: _____

Based on **table & graph 3**, what is the relationship between water intake and stomatal opening?

Based on **table & graph 3**, what is the relationship between stomatal opening and photosynthesis rate?

Table 7: The effect of wavelength of light on photosynthesis.

Wavelength (nm)	Photosynthetic Rate (O_2 ppt/min)
380 (violet)	2
420 (violet-blue)	43
460 (blue)	21
500 (green)	17
540 (green)	9
580 (yellow-green)	19
620 (yellow-orange)	41
660 (orange)	36
700 (red)	0.1

Graph the data in table 7. Plot wavelength on the x-axis and photosynthetic rate on the y-axis. This graph is an action spectrum of photosynthesis, as it shows the wavelengths at which the process is most active.

Relate the graph above to the fact that most leaves are green. Explain why being green is an adaptive advantage for plants. (Hint: If you are wearing a green shirt, it appears green because green light is being reflected!)