MiSP Photosynthesis Worksheet #2 – Photosynthesis and Temperature

Name _____ Date_____

Introduction: Many things affect the rate (speed) at which photosynthesis occurs: how much light (light intensity), temperature, and amount of carbon dioxide are a few factors. Scientists know that temperature affects the speed of chemical reactions. Photosynthesis is a series of chemical reactions.

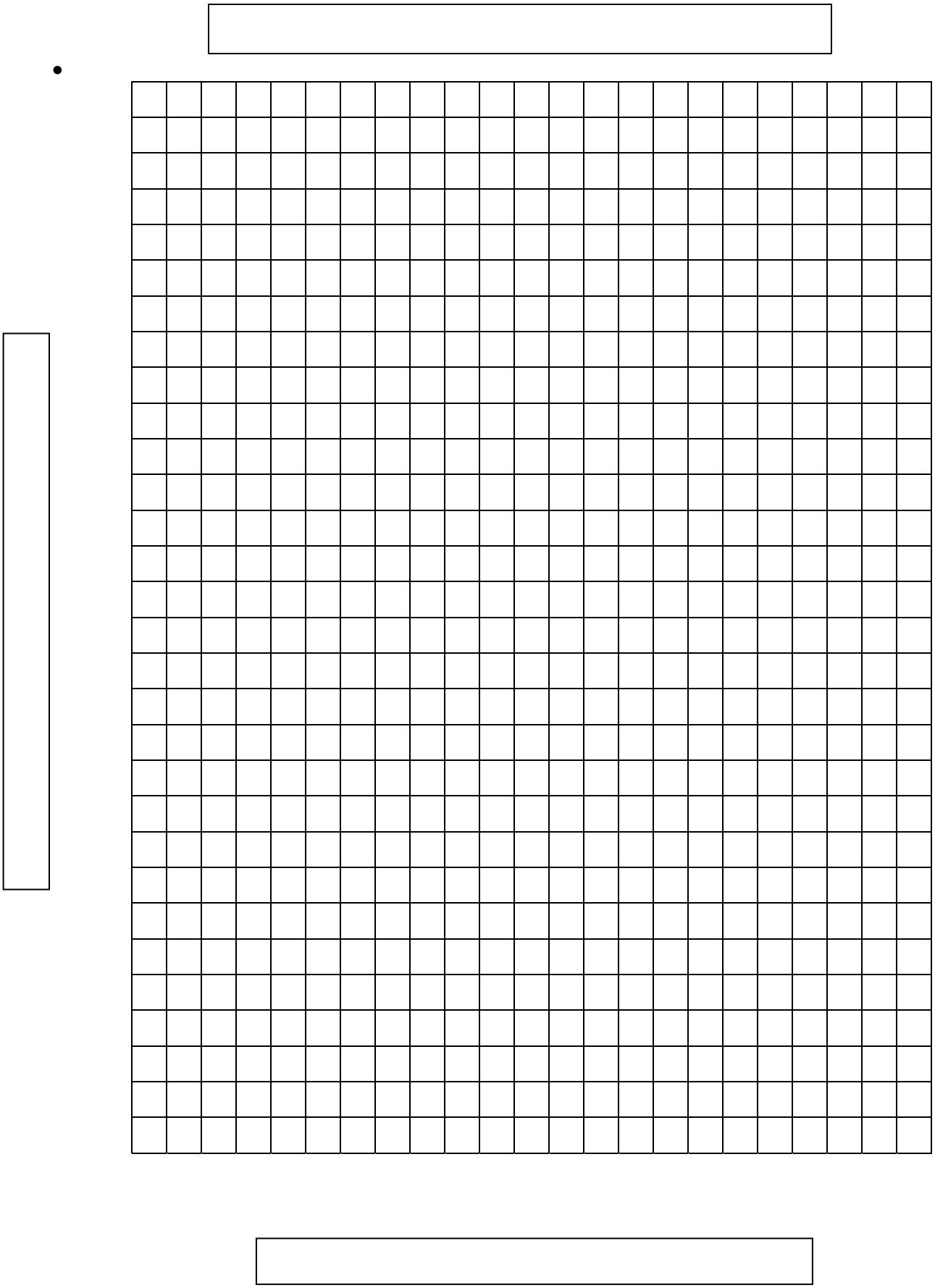
Scientists did an experiment on aspen trees to see how the rate of photosynthesis was affected by increasing temperature. They measured the speed of photosynthesis by measuring how much carbon dioxide was taken in to be used in photosynthesis.

Problem: What happens to the rate of photosynthesis as temperature is increased? The data in the table below were collected.

Temperature °C	Carbon dioxide used per second
10	8
15	12
20	16
25	20
30	24
35	28
40	21
45	14
50	7
55	0

Graph the data on the next page.

- The manipulated/independent variable is _____.
- Label the X axis
- The responding/dependent variable is _____.
- Label the Y axis
- Connect the data points with straight lines.



Discussion

1a. Complete this sentence: Between 10 and 35 °C the rate of photosynthesis

_____.

1b. Complete this sentence: Between 35 and 55 °C the rate of photosynthesis

_____.

2 . How does the rate of photosynthesis compare between 10 °C and 20 °C?

_____

3. Why doesn't the rate of photosynthesis keep increasing as the temperature increases? Hints – in humans a high temperature much above 37 °C (98.6 °F) can be fatal.

_____

_____

_____

4. Use the graph to predict the rate of photosynthesis at the following temperatures:

- 17 °C _____
- 38 °C _____
- 60 °C _____

5. Use the information <u>from the graph</u> to calculate the unit rates of change for the carbon dioxide used. Use the formula to complete the chart on the next page.

$$\text{Unit Rate of Change} = \frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{\Delta \text{ Carbon dioxide used per second}}{\Delta \text{Temperature}}$$

Graph segment Ordered Pairs (x_1, y_1) (x_2, y_2)	**ΔCarbon dioxide used per second** Δ y	**Δ Temperature** Δ x	**Unit Rate of Change** Δ y/Δ x
10-35 °C			
35-55 °C			

6. Look at the two unit rates of change calculated in #5. What do those numbers tell us about those sections of the photosynthesis rate graph? How does your answer support your sentence completions in 1a and 1b?

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_____

_____

7. Use the unit rates of change (slopes) for the lines between 10-35 °C and 35-55 °C, that you calculated in #5, the equation of a line, and one ordered pair from each line segment to determine the y-intercept for the lines from 10-35 °C and 35-55 °C. The equation for a line is

   y = mx + b
   where m is the unit rate of change (slope) and
   b is the y-intercept

y Intercept – Rate of photosynthesis graph line from 10-35 °C	y Intercept – Rate of photosynthesis graph line from 35-55 °C
m = Ordered pair (x, y) = (___ , ___) y = mx +b Solve for b:	m = Ordered pair (x, y) = (___ , ___) y = mx +b Solve for b:

8. Use the unit rates of change and the y intercepts you calculated above to write an equation for the lines on the rate of photosynthesis graph segments 10-35 °C and 35-55 °C,

Equation – Rate of Photosynthesis graph 10-35 °C	Equation – Rate of Photosynthesis graph 35-55 °C

9. Use the indicated equations to calculate the rate of photosynthesis at the indicated temperatures.

Use the equation for 10-35°C	Use the equation for 35-55°C
14 °C	47 °C
38 °C	38 °C

10. Why are the results for 38 °C different? Are we able to determine which is correct?

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