MiSP Photosynthesis Worksheet #2 L3

Name _____ Date_____

PHOTOSYNTHESIS AND TEMPERATURE

Introduction:

Many things affect the rate (speed) at which photosynthesis occurs: the amount of light (light intensity), the temperature, and the 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.

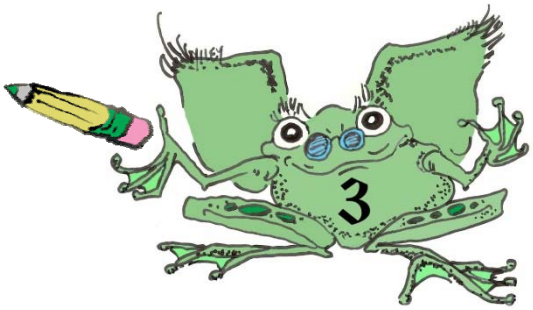
Scientists did an experiment on aspen trees to see how the rate of photosynthesis was affected by increasing temperature. They determined the speed of photosynthesis by measuring how much carbon dioxide was taken in to be used in photosynthesis.

Problem:

What happens to the rate of photosynthesis as temperature is increased?

The data in the table below were collected.

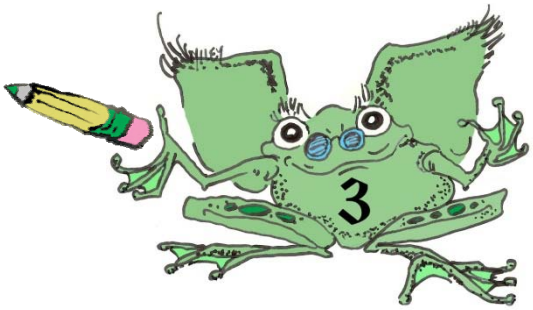
Temperature °C	Carbon dioxide used per second
10	8
15	12
20	16
25	20
30	24
35	28
40	21
45	14
50	7
55	0

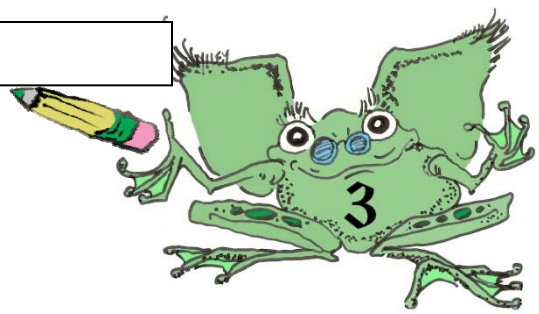


Graph the data:

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.

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Discussion Questions:

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

2. Complete this sentence: Between 35°C and 55°C the rate of photosynthesis _____.

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

   _____

4. Why doesn't the rate of photosynthesis keep increasing as the temperature increases? Hint: In humans a high temperature much above 37°C (98.6°F) can be fatal.

   _____

   _____

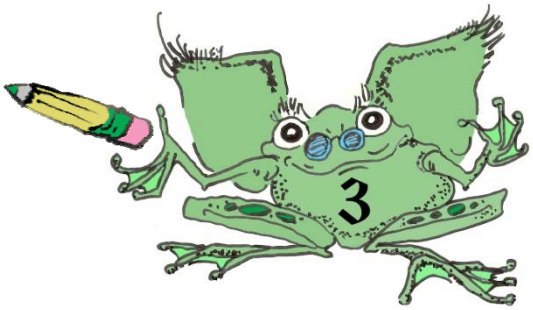
   _____

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

a. 17°C _____

b. 38°C _____

c. 60°C _____



6. 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.

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

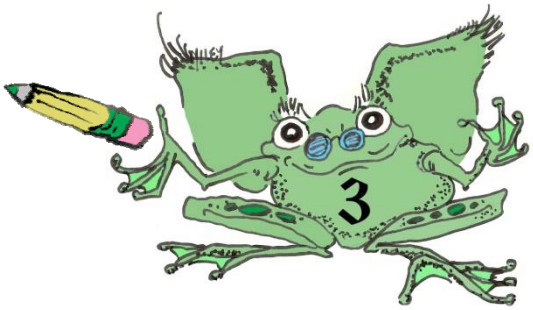
Graph segment Ordered Pairs (x_1, y_1) (x_2, y_2)	Δ Carbon dioxide used per second Δy	Δ Temperature Δx	**Unit Rate of Change** $\Delta y/\Delta x$
10°C–35°C			
35°C–55°C			

7. Look at the two unit rates of change calculated in #6. What do those numbers tell us about those sections of the photosynthesis rate graph? How does your answer support your sentence completions in 1 and 2?

_____

_____

_____



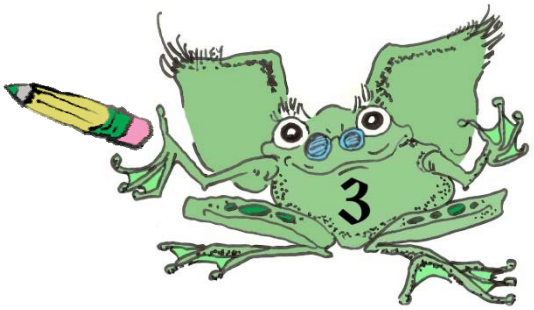
8. Use the unit rates of change (slopes) for the lines between 10°C and 35°C and between 35°C and 55°C that you calculated in #5, the equation of a line, and one ordered pair from each line segment to determine the *y*-intercept for the lines between 10°C and 35°C and between 35°C and 55°C.

   Use the equation for a line to calculate the *y*-intercept. 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 between 10°C and 35°C	*Y*-Intercept – Rate of photosynthesis graph line between 35°C and 55°C
$m =$ Ordered pair $(x, y) = (\_\_\_, \_\_\_)$ $y = mx + b$ Solve for b:	$m =$ Ordered pair $(x, y) = (\_\_\_, \_\_\_)$ $y = mx + b$ Solve for b:

9. 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 between 10°C and 35°C and between 35°C and 55°C.

Equation – Rate of Photosynthesis graph line between 10°C and 35°C	Equation – Rate of Photosynthesis graph line between 35°C and 55°C



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

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

11. Why are the results for 38°C different? Can we determine which is correct?