**Part 2: Student Investigations**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_

AP Biology, Mrs. Oldendorf

Now that you have an idea of how a respirometer works and what the “baseline rate” for germinating peas and non-germinating peas are, what would you like to change? Think about a variety of variables that you can change. List them in the space below.

List Possible Variables to Change, then circle the one your group is doing:

Independent Variable(s):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent Variable(s):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How will they be measured? Be specific!!! What units?

Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hypothesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Constants:

Procedure:

Steps Pictures

Data Table: *(the two variables are germinating and non-germinating)*



**Share your data with the class on the chart on the board or computer.**

**Analysis and Questions:**

Graph the class data (for both variables) for the different conditions. Give your graph a title, correctly orient the axes, use a key, etc…



Calculate and record the rate of oxygen (O2) consumption for each of the lines above (each variable). Remember that the rate is determined by calculating the Δy/Δx. Show your calculations and the final rate.

 Condition: Rate Calculations: Rate:

 1.

 2.

 3.

 4.

**Complete the following concerning YOUR DATA and YOUR EXPERIMENT/VARIABLE.**

1. What is the question you were asking?
2. Based on your experimental results, what CLAIM can you make regarding your variable?
3. What evidence(s) do you have that supports this claim?
4. How can you EXPLAIN the reasoning behind this claim using your knowledge of scientific processes and biology?
5. What errors could have been made during your experiment? List at least 2 sources of error, what type an error (procedural, mathematical, boo-boo, design flaw, etc.), and how it may have affected the numbers in your outcome.

**PART III:** Data from a temperature experiment.

Answer the questions based on the experimental results.



1. What two variables are being tested in this experiment?
2. Graph the corrected differences for germinating peas @25C, germinating peas @ 10C, dry peas @25C, and dry peas @10C on the graph below.



1. Calculate the rates of cellular respiration for each of the lines on your graph above. Remember, calculate the rate with Δy/Δx (mlO2 @ 20min – mL O2 @ 0min/20min – 0min).



1. Describe the effect that each variable has on the rate of the reaction and EXPLAIN the molecular/ cellular reasons for the effect (be sure to talk about molecular kinetics, enzymes, mitosis, etc…).
2. The temperature coefficient (Q 10) represents the factor by which the rate (R) of a reaction

increases for every 10-degree rise in the temperature (T). The rate (R) may represent any measure of the progress of a process. For example, the rate may be the rate at which the products of a chemical reaction are produced (e.g., mmol/s). In a typical experiment, the rate of the physiological process under investigation is measured at two different temperatures, T1 and T2 (where T2 > T1), thus yielding the rate measurements R1 (measured at T1) and R2 (measured at T2), respectively. The Q10 equation (see below) is then used to estimate the Q10 for the process. The temperature unit must be either the Celsius or the Kelvin, and may not be any other unit, such as the Fahrenheit. Note that T1 and T2 do not need to be exactly 10 degrees apart in order to use this equation. Keep in mind that the same unit must be used for the two temperatures (T1 and T2) at which the rate measurements are obtained. Moreover, the rate measurements (R1 and R2) must have the same unit. Q10 values are useful because they may be used to infer mechanistic insight about the physiological process under investigation (see below).



Q 10 is the factor by which the reaction rate increases when the temperature is raised by ten degrees. Q10 is a unitless quantity.

• R 1 is the measured reaction rate at temperature T1 (where T1 < T2). Note that R1 and R2 must have the same unit.

• R 2 is the measured reaction rate at temperature T2 (where T2 > T1). Note that R1 and R2 must have the same unit.

• T 1 is the temperature at which the reaction rate R1 is measured (where T1 < T2). The temperature unit must be either the Celsius or the Kelvin, and may not be any other unit, such as the Fahrenheit. Note that T1 and T2 must have the same unit. T1 and T2 do not need to be exactly 10 degrees apart.

• T 2 is the temperature at which the reaction rate R2 is measured (where T2 > T1). The temperature unit must be either the Celsius or the Kelvin, and may not be any other unit, such as the Fahrenheit. Note that T1 and T2 must have the same unit. T1 and T2 do not need to be exactly10 degrees apart.

For each of the Temperature Pairs (Germinating @25C and Germinating @ 10C & Dry @ 25C and Dry @ 10C) calculate the Q10. Use the chart below to help you organize your calculations and answers. Hint: T1 = 10C, T2 = 25C

