Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class Period: \_\_\_\_\_\_

**Cellular Respiration and Photosynthesis Lab**

***PART 1: CELLULAR RESPIRATION***

**Purpose/Question:** Does exercise have any effect on the rate of cellular respiration?

**Materials:**

|  |  |  |
| --- | --- | --- |
| Test tube | Stop watch (Use your cellphone) | Goggles |
| Straw | Pen/pencil | Pipette |
| Bromothymol Blue solution | Graduated Cylinder | Small Beaker |
| Water |  |  |

**PROCEDURE:**

***Set-up:***

1. Obtain a clean test tube & using your pipette fill with 15 ml of water.
2. Add 5 drops of bromothymol blue to the test tube.

***Without exercise:***

1. Measure your resting heart rate
   1. Count # beats for 15 seconds, then multiply # beats by 4 = #beats/minute
   2. Record in data table #1
2. Exhale -- **SLOWLY** through the straw into solution in your test tube - partner records time until color change.
   1. Exhale slowly to avoid the solution from bubbling up
   2. Save the straw for next part – keeping it in your test tube is good place to store it
3. Clean this test tube.

***With exercise:***

1. Using the same test tube (now clean) fill with 15 ml of water and add 5 drops bromothymol blue.
2. Exercise vigorously for 5 minutes. (Jog in place, do jumping-jacks, etc.)
3. Immediately after you stop exercising, take your active heart rate
   1. Count # beats for 15 seconds, then multiply # beats by 4 = #beats/minute
   2. Record in data table #2
4. Exhale -- **SLOWLY** through the straw into solution in your test tube - partner records time until color change.
5. Clean this test tube & throw out used straw.
6. Record the “change in heart rate” and “change in time” on data table # 2

**DATA:  
Data Table #1 – Without Exercise**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **# Beats in 15 sec** | **X 4 = # Beats per minute** | **Time for indicator to turn blue to yellow (sec)** |
| **Partner 1** |  |  |  |

**Data Table #2 – After Exercise**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **# Beats in 15 sec** | **X 4 = # Beats per minute** | **Time for indicator to turn blue to yellow (sec)** |
| **Partner 1** |  |  |  |

**Graph:**

Create a **bar** graph that illustrates the relationship between the time it takes for the color of the bromothymol blue to change color before and after exercise. The Y-axis should be the time for the color change to occur and the X-axis should be trial 1 and trial 2.

Your graph must include:

* A title that clearly indicates what the graph is representing
* Labeled X and Y axes (with #’s!)
* A key or legend

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Legend/ Key

**Analysis:** Answer the following in complete sentences

1. Explain your graph, what does it show?

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2. What happened to the rate of cellular respiration after 5 minutes of exercise?

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1. Putting the data into your own words, would you say that exercise increased or decreased the rate of cellular respiration? Why does it increase or decrease?

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1. Which product of cellular respiration caused the color of the bromothymol blue to change?

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1. Did this test indicate that you produce more or less carbon dioxide after exercising? Explain why this happens.

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1. Which reactant of cellular respiration does your body need in order for cells to respire and make carbon dioxide, water and ATP?

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1. Did you notice during exercise that your body needed more oxygen to produce energy? How did your body compensate for that?

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***PART 2: PHOTOSYNTHESIS***

**Background:**

In this lab, you will investigate the process of photosynthesis. More specifically, you will learn how the amount of light affects photosynthesis. In order to do this, you will use an **Cabomba plant**, the chemical **Bromothymol Blue** (which acts as an indicator to show if photosynthesis is occurring). Bromothymol blue works because it is able to detect the presence of **CO2** (needed for photosynthesis) and **O2** (released during photosynthesis) in solution.

In a test tube, you will see that:

* bromothymol blue + CO2 = *green/yellow color*
* bromothymol blue + O2 = *blue color*

**Material Preparation:**

If concentrated bromothymol blue (BTB liquid) is available, dilute with water (distilled works best) and test the concentration by adding 10 ml of your BTB solution to 15 ml water and bubbling one lung full of air through a straw into the water. It should turn greenish. (If it stays blue, the BTB is too concentrated; if it turns yellow, the BTB is too diluted.) Adjust your solution as necessary and place in dropper bottles for lab teams to use.

**Procedure:**

1. Using the test tube from yesterday, blow into your test tube once more and make sure the liquid is completely yellow.
2. Add a 7 cm piece of Cabomba to the test tube. Using your straw, GENTLY push the Elodea to the bottom of the test tube. Then cover tube with tinfoil or plastic wrap and place it in the test tube rack.
3. Place the entire test tube rack under a light source and allow to sit for 24 to 48 hours.
4. Please note, your teacher will have 2 separate test tubes, one without the Cabomba, and one with the Cabomba leaf that will be kept in the dark.

**Results:** Record your results in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample** | **No Cabomba + Bromo blue + light**  **(Control)** | **Cabomba + Bromo Blue + no light**  **(Control)** | **Cabomba + Light + Bromo blue** |
| **Color Before Experiment** |  |  |  |
| **Color After**  **Experiment** |  |  |  |

**Analysis:**

What color does the bromothymol blue solution turn after you exhale into it? Why?

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What happened to the color in Test Tube after it sat for 24-48 hours? Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What happened to the color in the test tube without the Cabomba plant? Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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What happened to the color in test tube that was placed in the dark? Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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What is the purpose of the control? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What gas do you exhale? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What gas do plants give off? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

List three things that a plant needs to undergo photosynthesis.

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