**TAPE THIS HALF OF THE PAPER INTO YOUR LAB BOOK.**

**Exercise & Cellular Respiration**

**Purpose:**

The purpose of this lab activity is to analyze the effect of exercise on cellular respiration.

**Background:**

Cells normally contain small amounts of ATP produced during the **glycolysis** reaction of cellular respiration. Whenever the body needs lots of energy in a hurry, its cells quickly burn this stored ATP (in about 3-5 seconds). At this point, the cells of the body’s muscles are producing most of their ATP by **lactic acid fermentation,** the slow process by which glucose is converted to lactic acid. This process supplies around 2 ATP energy molecules for approximately 90 more seconds of activity. For exercise longer than 90 seconds, the cell has to complete two more reactions for energy. These two reactions are called the **Krebs Cycle** and the **Electron Transport Chain**. These two reactions are the only way to generate a continuing supply of ATP. This is because the two reactions release energy much faster than Glycolysis and/or lactic acid fermentation. For the first 15 minutes of prolonged activity, your body uses energy stored in glycogen (this is a stored form of glucose). After using the available glycogen, the body begins to burn energy stored as fat. This is one reason why ***aerobic exercise*** is so beneficial to weight control – it helps you burn off that extra “love.”

**Materials:**

2 test tubes bromothymol blue solution (BTB) 1 straw per person stop watch (or clock)

**Pre-Lab:** *Use your background information AND your Cellular Respiration notes to answer the following pre-lab questions. You must answer these correctly before you can do the lab.*

1. What is the **equation** for cellular respiration? **Label**  which items are the **reactants** and the **products**.

1. What are the 3 reactions (steps) of Aerobic Cellular Respiration? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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2. In what part of the cell does cellular respiration occur? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. **THINK**: After which reaction is CO2 released? (***hint****: it is only one of the 3*) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. **Write a hypothesis** of how exercise will affect your body’s production of carbon dioxide (i.e. do you think your body will produce *more* or *less* carbon dioxide as you exercise). Make sure you **EXPLAIN WHY** you think this. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure:**

1. Place two test tubes (**A**: resting test tube) and (**B:** exercise test tube**)** in a test tube rack.
2. Place **15 drops** of BTB into each test tube

**NOTE** 🡪 C*arbon Dioxide (CO2) causes Bromthymol Blue to turn YELLOW/GREEN.*

1. YOUR PARTNER WILL TIME YOU DURING THIS STEP:
	1. When your partner says “GO” **SLOWLY** blow air through a straw into the bottom of test tube A.***Do not put your straw directly into the solution!*** **CAUTION: DO NOT INHALE THROUGH THE STRAW!!!!!!!!!!!!!!!!**
	2. When the solution changes color to yellow, your partner should say “STOP”.
	3. Record how long it takes (in seconds) for the BTB to change from blue🡪yellow. Write your results in the table below.
2. Now perform physical exercise for 2 minutes (run up and down the stairs, run outside, jump in place, etc.). **CAUTION: *DO NOT*** *do this if you have a medical condition that interferes with exercise. If you feel dizzy, stop immediately and sit down!*
3. **Repeat step 3** using test tube B – don’t forget to record your results! Match the color of the solution to the color that was produced in the “rest” breath.
4. Pour used solutions into the sink and rinse test tubes gently with water.
5. Now trade roles with your partner. Repeat steps 1-6 using the same beakers and a different straw.
6. Record data for ALL PARTNERS in your data table.
7. CLEAN UP! (Rinse test tubes and replace in test tube rack, throw away straws, put cap on BTB bottle, wipe table and pick up any trash around your work station.)

**Data: (COPY THIS DATA TABLE INTO YOUR LAB BOOK)**

|  |  |  |
| --- | --- | --- |
|  | **Time (sec) Needed to Change Color** **Tube A (Resting)** | **Time (sec) Needed to Change Color Tube B (Exercise)** |
| **ME** |  |  |
| **Partner \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |  |  |
| **Partner \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |  |  |

**Analysis & Conclusions:** *Answer the questions below using your BACKGROUND information in the lab, as well as your lab data. ANSWER THE QUESTIONS IN COMPLETE SENTENCES IN YOUR LAB BOOK***. DO NOT ANSWER THEM IN THE SPACE BELOW!**

1. What was the purpose of this lab?
2. How did exercise **affect the time** needed for the solution to change color?
3. Was your hypothesis supported? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Explain your answer.
4. What process in your body produces carbon dioxide?
5. How does exercise affect this process (from question #4)?
6. Why is aerobic exercise a good thing?
7. **THINK**: What are some reasons (provide at least 2) why your time may be different from your partners time? Use the word glucose and/or glycogen in your answer.
8. Other than Aerobic Cellular Respiration, what is another type of respiration used for supplying energy?
9. Using your answer to #8, what are 2 examples of this type of respiration **AND** what are the products of each type? Refer to section 9-1 in your textbook.
10. List some activities (at least 3) that are **anaerobic**. Explain why they are considered anaerobic.