Name: _____

Lab: Exercise & Cellular Respiration

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

Background: This lab will address how exercise (increased muscle activity) affects the rate of cellular respiration. You will measure 3 different indicators of cellular respiration: breathing rate, heart rate, and carbon dioxide production. You will measure these indicators at rest (with no exercise) and after 1 and 2 minutes of exercise. Breathing rate is measured in breaths per minute, heart rate in beats per minute, and carbon dioxide in the time it takes bromthymol blue to change color.

Carbon dioxide production can be measured by breathing through a straw into a solution of bromthymol blue (BTB). BTB is an acid indicator; ***when it reacts with acid it turns from blue to green/yellow***. When carbon dioxide reacts with water, a weak acid (carbonic acid) is formed. The more carbon dioxide you breathe into the BTB solution, the faster it will change color to green/yellow.

Procedure:

PART A: Resting (no exercise)

Measuring Carbon Dioxide Production:

1. Use a graduated cylinder to measure out 20 mL bromthymol blue solution into a beaker.
2. Using a straw, exhale into the BTB solution. (CAUTION: Do not inhale the solution!)
3. Time how long it takes for the blue solution to turn green/yellow. Record the time in **Table 1**.
4. Wash out the beaker.

Measuring Breathing Rate:

1. Count the number of breaths (1 breath = inhale + exhale) you take in 1 minute. Record this in **Table 2**.

Measuring Heart Rate:

1. Have your partner help take your pulse.
2. Count the number of beats in 30 seconds and multiply that number by 2. Record this in **Table 3**.

PART B: Increased Muscle Activity (Exercise)

1. Use a graduated cylinder to measure out 20 mL bromthymol blue solution into a beaker.
2. Exercise for exactly 1 minute by doing jumping jacks.
3. After 1 minute of exercise, immediately exhale through the straw into the BTB solution. Time how long it takes for the BTB to turn green/yellow. Record this in **Table 1**.
4. Then quickly calculate your breathing and heart rates as you did before.
5. Record these values in **Tables 2 & 3**.
6. Have your partner get 20 more mL of BTB in a beaker.
7. Exercise as you did before, but for 2 continuous minutes.
8. Immediately exhale through the straw into the BTB solution. Time how long it takes for the BTB to turn green/yellow. Record this in **Table 1**.
9. Then quickly calculate your breathing and heart rates as you did before.
10. Record these values in **Tables 2 & 3**.
11. **Repeat this entire procedure for your lab partner.**

Data:

Table 1: Carbon Dioxide Production (TIME it takes BTB to change color)

	Student 1	Student 2
Resting		
After 1 min. of exercise		
After 2 min. of exercise		

Table 2: Breathing Rate (breaths/minute)

	Student 1	Student 2
Resting		
After 1 min. of exercise		
After 2 min. of exercise		

Table 3: Heart Rate (beats/minute)

	Student 1	Student 2
Resting		
After 1 min. of exercise		
After 2 min. of exercise		

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*

1. What is the **equation** for cellular respiration?

2. How did exercise affect the time needed for the solution to change color? Explain why the color change occurred (How does BTB work?)

3. What can you conclude about the effect of exercise on the amount of carbon dioxide that is present in your exhaled breath? Why is this so?

4. What can you conclude about the effect of exercise on breathing rate? Why is this so?

5. What can you conclude about the effect of exercise on heart rate? Why is this so? What do your muscles need during exercise that the blood brings?