

Name: _____

Period: _____ Date: _____

The Effects of Exercise on Cellular Respiration

Background Information: Cellular respiration uses glucose, a simple sugar, and oxygen to make energy in the form of ATP. After digestion, food is absorbed through the walls of the small intestines into the blood stream. The blood carries the monomers, along with other needed nutrients to cells. Oxygen moves from the lungs into the blood. The blood then carries oxygen to cells for cellular respiration. As cells make energy using oxygen and glucose, ATP is produced, along with the waste product CO₂. As CO₂ is produced blood cells carry it to the lungs to be exhaled. The equation for cellular respiration is below.



The rate of cellular respiration can be determined by measuring reactants and products. In this lab, the rate of carbon dioxide production is indirectly measured using bromothymol blue, a chemical indicator that changes color as the pH of a solution changes. It is yellow in acidic solutions and blue in basic and neutral solutions. When carbon dioxide (CO₂) is dissolved in water, it creates carbonic acid (H₂CO₃) and hydrogen ions (H⁺) with a pH of about 5.7. By measuring how quickly you produce carbon dioxide the rate of cellular respiration can be determined.



PreLab Questions: MUST RSQ and answer thoroughly!

- How is breathing related to cellular respiration? What products enter the cells from inhaling and which exit from exhaling?
- How and WHY will exercise affect the rate of cellular respiration?
- What molecule do we need more of for strenuous activity? _____
- How can bromothymol blue pH help you measure your rate of cellular respiration?

Materials:

Stopwatch drinking straw bromothymol blue solution beaker SAFETY GOGGLES

Procedure: SAFETY: Do not inhale the solution! Exhale from your lungs! Googles On YOUR FACE

- Fill the Erlenmeyer flask with about 50ml bromothymol blue solution.
- Assign one person to be the timer and one person to perform the experiment.
- When the timer says, "START," the experimenter will exhale through the straw into the bromothymol blue solution until the color changes from blue (basic) to green (more acidic).
- Your partner will stop the time as soon as the color changes.
- Record the time it took for the color change in the observation table below.
- Pour the bromthymol blue into the waste Erlenmeyer flask.
- Rinse out the beaker and refill with 50 mL bromothymol blue solution.
- Now have the experimenter do jumping jacks or a similar exercise for **30 seconds**. You should feel a little winded when you are finished!
- Using the same straw, exhale into the solution the same way as in the control and record how long it takes for the solution to change color. Repeat with increasing time spent exercising. Then change roles – timer versus subject.

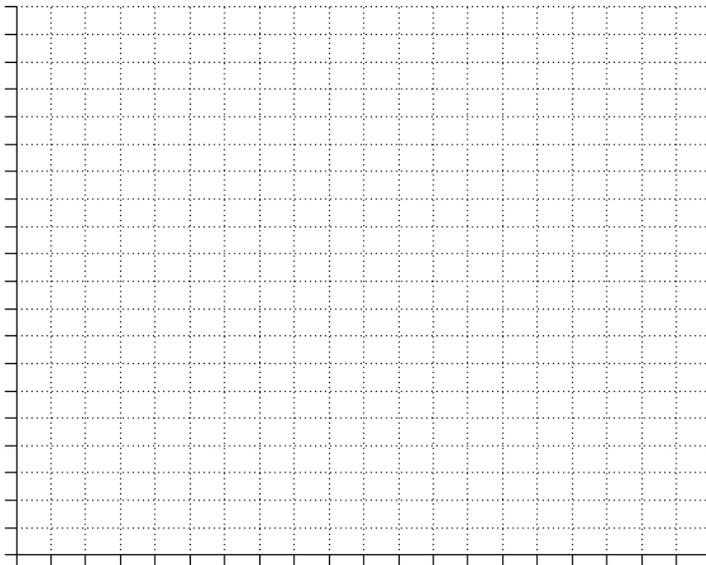
THE EFFECT OF EXERCISE ON THE RATE OF CELLULAR RESPIRATION

Time spent exercising (seconds)	Time it take for color to change (seconds)
0	
30	
60	
90	

Analyze and Apply: (RSQ- Answer #2 – 5 in complete sentences).

1. Make a graph of your results. Carefully decide which variables belong on the X axis and Y axis. **Remember to label the X and Y axes and provide a title that relates the 2. TAILS**

Title: _____



Experimental Design

Experimental Group _____

Control Group _____

Independent Variable _____

Dependent Variable _____

Control Variables _____

2. Compare the time it took the bromothymol blue solution to change color before exercise and after exercise. Explain why there was a difference. Use DATA and answer WHY
2. Using your graph, predict the time it would take the color to change at 2 minutes of exercise. Would it continue to decrease to zero? Explain.
4. In this investigation, we measured the amount of carbon dioxide produced to find the rate of cellular respiration. What else could we measure to find out the rate of respiration? Would the compound measured be expected to increase or decrease?
5. Use the equation for the creation of carbonic acid to explain why it is so important to exhale completely when doing exercise.
6. What chemical equation explains how you produce CO₂? Write the equation out completely.
7. In what cell organelle is most of this activity happening? _____