CELL RESPIRATION INQUIRY LAB

HOW DOES EXERCISE AFFECT THE RATE OF RESPIRATION IN ANIMALS?

PART I: DECIDING ON A HYPOTHESIS

Make a prediction. How do you think exercise affects the rate of cellular respiration? Explain your answer.

Now let's consider how we can measure the rate of cellular respiration. Think about why cellular respiration occurs. **Do you think it is possible to measure any of the products of cell respiration? Which one we could easily measure?**

Hypothesis: The amount of cellular respiration increases when a person exercises, so as a result he/she will produce a greater amount of carbon dioxide, a product of cellular respiration, than when at rest.

Dependent Variable:

Independent Variable:

Now, we will test our hypothesis.

First, we have to set a baseline by determining how much carbon dioxide you normally produce while at rest. To do so, we will count the number times you exhale while at rest during one minute. Record that number here:

_____times exhaled per minute

Now, we will compare this number to the times exhaled per minute after exercise. To do this, we will do jumping jacks for one minute. When finished, count the number of times you exhale in one minute and record that number here:

_____times exhaled per minute (after exercise)

Now, we will rest. While resting, let's discuss other methods that can be used to determine the amount of carbon dioxide exhaled during this experiment. Before we can do that, we must talk about acids and bases. (A good website for review: http://www.chem4kids.com/files/react_acidbase.html) When carbon dioxide is exhaled into water, it forms a weak acid. An acid is a solution that has a pH lower than 7 on the pH scale.

Certain substances, called indicators, can be used to measure changes in pH. They "indicate" a change in pH by changing color. Bromthymol blue is the name of an indicator that turns from blue to yellow when the pH of a solution becomes slightly acidic, meaning the pH drops below 7.

The more carbon dioxide added to water, the more acidic it becomes. To reverse the effect of the carbon dioxide, a base can be added until the solution returns back to its original pH. Ammonia is a base and will be used for this purpose. We will know when the solution is "back to normal" when the color changes back to its original color before the carbon dioxide was added.

What can you infer about the amount of carbon dioxide in solution based on the amount of ammonia added?

PART II

To quantify the amount of carbon dioxide produced during this experiment, we will use the following method (you will need a partner for this part):

1. Using a graduated cylinder, measure out 30 ml of bromthymol blue solution and pour it into an Erlenmeyer flask.
2. Using a different graduated cylinder, measure out approximately 50 ml of ammonia solution and pour it into a beaker to use in part 4.
3. Get a drinking straw. Have one member of the group use the straw to breathe out normally into the bromthymol blue solution for exactly one minute. ***Be careful not to suck the bromthymol blue solution into your mouth.*** The solution should turn a pale yellow after one minute.
4. With a pipette, add 1 drop of ammonia at a time swirling the flask between each drop to ensure it is mixed in. Count the number of drops it takes for the solution to return to blue. Record this number here:

Number of Ammonia Drops (before exercise)

Trial 1 _____

Trial 2 _____

Trial 3_____ Average _____

Repeat steps 3 and 4 two more times using the same bromthymol blue solution. Find the average and record it above.

PART III

Now, let's do the same, but after exercising. Prepare steps 1 and 2 as written above. Now, have the same group member who was the test subject above do jumping jacks for one minute. Repeat steps 3 and 4 from Part II. ***Again, be careful not to suck the bromthymol blue solution into your mouth.*** Record the number of drops of ammonia added to the solution after exercise.

Number of Ammonia Drops (after exercise)

Trial 1 _____

Trial 2 _____

Trial 3_____ Average _____

Using the same bromthymol blue solution, complete 2 more trials, repeating steps 3 and 4 just as you did in Part II. Record the results of those trials above. Calculate the average for all 3 trials and record that above as well.

ANALYSIS AND CONCLUSIONS:

1. **Did the data support the hypothesis? Explain.**

2. **Why does one's breathing rate change after exercise?**

3. **What factors might limit the rate of cellular respiration in an individual?**