

The Relationship between Exercise and the Concentration of Carbon Dioxide in Exhaled Air

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Purpose: We are testing the concentration of carbon dioxide after a specified time of exercise, and watching how the amount of exercise changes with the exhalation of carbon dioxide. This experiment should show the relationship between these two variables.

Background: To be able to test the carbon dioxide in exhaled air, we use Bromothymol blue, a liquid able to indicate¹ the level of acid in a chemical by turning from blue to yellow when the pH (level) of the element is low, (which means it is acidic.) As carbon dioxide is considered acidic, the faster the liquid turns yellow, the more carbon dioxide is in the exhaled air. This ingredient will be essential in this experiment.

Hypothesis: The amount of time the Bromothymol Blue will take to turn yellow will decrease as the amount of time to exercise increases. This will be so because exercising will cause more oxygen intake and will lead to breathing out more carbon dioxide.

Materials:

- Fifteen drops of Bromothymol blue
- Distilled water
- Pyrex No. 9800 test tube
- Stopwatch
- 2 hole stopper
- No-hole stopper
- Liquid dropper
- Straw

Procedure:

Preparation:

1. Fill a Pyrex No. 9800 test tube half way with distilled water.
2. Drip fifteen drops of the Bromothymol blue from the liquid dropper into the test tube filled with distilled water.
3. Shake it up correctly by applying a no-hole stopper and rotating it until the Bromothymol blue mixes properly with the distilled water. (The result should be a watery blue color.)
4. Take off the no-hole stopper and apply the 2-hole stopper on the opening of the test tube, making sure to carefully exert little pressure so the test tube does not break.

¹ Bromothymol blue can be classified as an indicator, or an element that will indicate a change in another element. In this case, it is the pH of an element.

- Use a thin straw and insert it into one of the holes so that the straw is submerged throughout the diluted Bromothymol blue.

Experimentation:

- The subject will begin blowing gently into the prepared vial of diluted Bromothymol blue after each trial.²
- The subject will continue blowing until the Bromothymol blue resembles a yellowish color.
- A stopwatch will be counting the seconds it takes for the Bromothymol blue to turn yellow. (Another individual who is a participant in this experiment will perform this.)
- The experimentation process will be repeated until all trials are finished and completed according to their specifics.³

Data: These are the results the experiment yielded after completing the procedure.

<i>Trials</i>	<i>Amount of Exercise</i>	<i>The Time that Lapsed for The Bromothymol Blue to Turn Yellow.</i>
First Trial	No Exercise	6.32 Seconds
Second Trial	10 seconds	4.59 seconds
Third Trial	20 seconds	5.63 seconds
Fourth Trial	30 seconds	6.25 seconds
Fifth Trial	1 min. 30 sec.	6.44 seconds
Sixth Trial	Rest for 2 min., 30 sec.	5.16 seconds

² Each vial will be prepared in the duration of the exercises, (as described in footnote three), and will be ready by the time the subject is finished with the specified amount of exercise.

³ Here is a diagram, which details the specific amount of exercise our subject will perform for each trial. This will be used in accordance with the procedure.

Trials	Time or Description of Action
First Trial	No Exercise; immediately start blowing into test tube after the step of preparation
Second Trial	10 sec. of sit ups
Third Trial	20 sec. of sit ups
Fourth Trial	30 sec. of sit ups
Fifth Trial	1 min. 30 sec. of sit ups
Sixth Trial	2 min. 30 sec. of rest (Can be performed by completing movements that will not strain or be strenuous for the subject.)

Conclusion: After thoroughly performing each trial, the result that was agreed upon was that the speed of the change for the Bromothymol blue to turn from blue to yellow did not increase; in fact, the speed actually sporadically slowed in some trials, while in others, the speed surprisingly increased. All in all, the data was very unpredictable and included no pattern whatsoever, as you can see in the table above.

Many variables went unplanned in this experiment. One of them included the unexpected way the Bromothymol blue started indicating even before the subject was finished with the exercises that they were given. Another was the lack of closed stoppers (no-hole) and other various supplies. This shows that the experiment could have possibly been done a bit better and would have been a bit more accurate if these variables were fixed/eliminated. Overall, the experiment yielded possible results, though, again, could be improved upon.