I’ve got the power

Does the level of carbon dioxide in my breath change after exercise?

What happens to our breathing when we exercise? Why might the volume of carbon dioxide we produce change after exercise? Predict how the number of breaths it takes to neutralise an alkaline solution before exercise will compare to the number of breaths it takes to neutralise the same solution after exercise.

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Obtaining the evidence

1. Work in pairs or small groups. Wearing safety goggles, use a pipette to add 5 cm³ of 0.1 M sodium hydroxide solution to the respirometer containing bromothymol blue solution. 0.1 M sodium hydroxide solution causes skin and eye irritation and should be handled with care. Then press the bung with the tubing in it into the neck of the bottle making sure the hard tubing reaches into the liquid. The others will act as time-keepers and look for the colour change.

2. One person should practise breathing in through your nose and out through their mouth.

3. While seated and relaxed, breathe out through your mouth into the respirometer containing the bromothymol blue solution and sodium hydroxide. Do not breathe in the bromothymol blue/sodium hydroxide solution from the bottle. Use normal breaths. Do not increase the volume of air you breathe out at each breath. You need to breathe in through your nose and out through your mouth, as you practised in step 2.

Using the respirometer.

4. Count how many normal breaths it takes to change the colour of the bromothymol blue/sodium hydroxide solution from blue (pH > 7.6) to green (indicating pH 7). Use your indicator chart as a guide to when it has reached pH 7. Also time how long it takes (in seconds) for this to happen using a stopclock. Write your results in the table at the end of the next sheet.
5 Before you start the next exercise, another person in your group should replace the used bromothymol blue/sodium hydroxide solution in the respirometer with a fresh mixture of 500 cm³ of bromothymol blue and 5 cm³ of 0.1 M sodium hydroxide solution. They should wear safety goggles and avoid skin contact with the bromothymol blue solution and sodium hydroxide solution.

6 Get someone to time you while you do at least 1 minute of high-intensity anaerobic exercise such as squats. Do them as quickly as possible.

7 When you have finished exercising breathe out into a respirometer containing the fresh bromothymol blue and sodium hydroxide. Count how many breaths it takes for the colour to change to indicate pH 7. Time how long it takes for this to happen (in seconds). Write your results in the table below.

8 Wait at least 3 minutes, preferably longer, for your cardiovascular system to recover. While this is happening, someone else in your group should replace the used bromothymol blue solution in the respirometer with 500 cm³ of bromothymol blue and 5 cm³ 0.1 M sodium hydroxide solution. Now do 2 minutes of more gentle aerobic exercise. You may want to skip, dance/Zumba®, or do the step exercise.

9 Repeat stage 7 and record the results in the table below.

Presenting the results

Complete the table below with your results.

<table>
<thead>
<tr>
<th>Level of activity and type of exercise</th>
<th>At rest</th>
<th>Exercise 1</th>
<th>Exercise 2 (if time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td></td>
<td>Activity</td>
<td></td>
</tr>
<tr>
<td>Number of breaths (N) needed to neutralise indicator /sodium hydroxide solution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time taken for this number of breaths (seconds)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Squats.

www.getinthezone.org.uk