Exercise Lab

ANYWHERELABS

STEM LEARNING FOR GRADES 6-12

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Cellular respiration is a chemical reaction that occurs in your cells to create energy in the form of adenosine triphosphate (ATP). This ATP can be used to power proteins in your cells and can even be used to power the proteins that help you move. For example, when you are exercising, your muscle cells are creating ATP to provide energy to the proteins in the muscles, allowing them to contract. Aerobic cellular respiration requires oxygen to create this energy in addition to carbon dioxide.

This lab will address how exercise affects the rate of cellular respiration. You will measure three different indicators of cellular respiration: breathing rate, heart rate, and carbon dioxide production. Breathing rate is measured in breaths per minute and heart rate is measured in beats per minute. You will measure carbon dioxide production by exhaling through a straw into water then measuring the pH. When carbon dioxide dissolves in water it creates carbonic acid (H_2CO_3). The more carbon dioxide in solution the more acidic and lower in pH the water will become.

What other measures might impact the rate of cellular respiration?

LEARNING UNDEFEATED

MATERIALS

From the Exercise Lab bag	From the Box	From Home
• pH strips • Straws	• 1 large tube (50mL)	• Cup • Water

LABORATORY PROTOCOL

1. Gather all supplies listed on the "Exercise Lab" bag.
2. Use the large tube (50mL) to measure 150mL of water into your cup. You will need 150mL of fresh tap water before every carbon dioxide test.
3. Review the procedures for each test below, then continue to follow this protocol.
4. After a period of rest (no exercise), measure carbon dioxide production using the following procedure and record your pH below:

   a. Using a straw, exhale into the water for 30 seconds. (Caution: Do not inhale the water!).

   b. Use a pH strip and record the pH below.

      i. Dip the strip into the water and immediately compare the color of the three squares to the provided pH color test card.
5. Calculate your breathing rate using the following procedure and record your result below:

   a. Count the number of breaths (1 breath = inhale + exhale) you take in 1 minute.
6. Calculate your heart rate using the following procedure and record below your result below:

   a. While you calculate your breathing rate, have a partner take your pulse.

   b. Count the number of beats in 30 seconds and multiply that number by 2.
7. Dispose of the water and measure 150mL of fresh tap water.
8. Exercise for 1 minute. Examples of aerobic exercises include jumping jacks, sit ups, sprints, or bicep curls with a weight or water bottle in hand.
9. Immediately exhale through the straw into the water for 30 seconds and record the pH on the next page.

10. Quickly calculate your breathing and heart rates and record below.
11. Dispose of the water and measure 150mL of fresh tap water.
12. Exercise for 2 minutes using the same exercise used for step 8.
13. Immediately exhale through the straw into the water for 30 seconds and record the pH below.
14. Quickly calculate your breathing and heart rates and record below.

Exercise	pH of Water	Breathing Rate	Heart Rate
Rest (no exercise)			
1 minute			
2 minutes			

EXTENSION ACTIVITY

Design an experiment to learn how regular exercise affects these metrics.