Get Energized with Cellular Respiration!

Name: _____

Date: _____

Student worksheet

Directions: Answer the questions below in preparation for the experiment.

Think Through Your Experiment

1. Draw a picture, write an equation, or describe in a few sentences how breathing is part of cellular respiration.

2. Why does the indicator solution change color when you exhale into it? Hint: your answer needs to discuss carbon dioxide and acids.

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Directions: Answer the questions below and follow the steps to conduct your experiment.

3. What are the independent and dependent variables in your experiment? Remember, an independent variable is what you change; dependent variables are what you measure.

4. Write down your prediction about how exercising will affect the rate of color change when you exhale into the indicator solution. Write 1–3 sentences explaining why this is your prediction.

Experiment

5. Follow these steps to conduct your experiments.
   a. Practice exhaling through a straw into water. Assign one person in your group at a time to perform the experiment. Each member of your group should do the experiment once.
      i. Fill the cup two-thirds full with water.
      ii. Cover the cup with plastic wrap and secure it with a rubber band.

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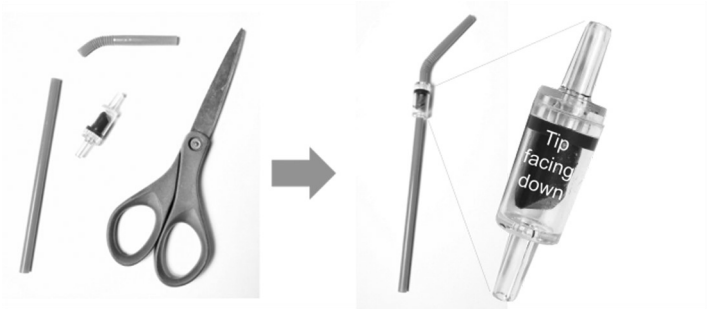
Name: _____

Directions: Continue following the steps below to conduct your experiment.

iii. Use the straw to poke two holes into the plastic wrap, as shown (right).



iv. Each group member should prepare his/her own straw. Cut the straw and reassemble as shown with safety valve. The safety valve will prevent you from accidentally sucking up the indicator solution. If you do not have your own safety valve, you can share one by inserting it into your own straw when it is your turn.



v. Stick the bottom of the straw through the hole closer to the rim of the cup.

vi. Take a deep breath, and start exhaling through the straw into the water for as long as you can.

b. Now do the experiment with indicator solution instead of water.

i. Fill the cup two-thirds full with water.

ii. Add 2 mL (half a teaspoon) 0.04% bromothymol blue indicator solution.

iii. The solution should be green or blue depending on the pH of your water.

iv. Repeat steps a.ii-a.vi. But this time, start a stopwatch immediately before the experimenter starts exhaling into the indicator solution. Each member of your group should use his/her own straw. If you do not have your own safety valve, you can share one by inserting it into your own straw when it is your turn.

v. Stop the stopwatch once the color has changed from blue-green to yellow and does not change anymore. Record the time in the table on the next page.

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Directions: Continue following the steps below to conduct your experiment.

c. Take turns so each group member performs the experiment once, following step b. again. Record all your measured times in the data table.

d. Prepare a fresh straw; you can still reuse the safety valve. Then repeat steps b. and c. again, but before you start exhaling into the indicator solution, do jumping jacks for one minute. Try to exhale into the straw the same way you did before exercising. Again, take turns, so each group member performs the experiment after exercising once and don't forget to record all your measured times.

Experimental condition	Time of color change [s]				
	Student 1	Student 2	Student 3	Student 4	Average
Before exercising					
After exercising					

6. Calculate the average time of color change from all group members before and after exercising. Record your calculations in the table.
7. How did exercising affect how long it took for the indicator solution to change color?

Reflect

8. What does your experiment tell you about how exercising affects cellular respiration? Explain your thinking.