

Name: _____

Date: _____

Cellular Respiration

Aerobic vs. Anaerobic

Introduction


Our cells produce energy, in the form of ATP, for cellular work through a process called cellular respiration. This can be accomplished without oxygen (anaerobically), or more productively, with oxygen (aerobically). During *aerobic* respiration our cells produce energy efficiently and are capable of performing an activity for an extended period of time as long as enough oxygen is available.

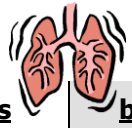
In the absence of oxygen, however, our cells perform *anaerobic* respiration, or fermentation, to produce energy. During this process the byproduct *lactic acid* builds up within our cells causing muscle fatigue, a burning sensation, and even cramps. This process supplies us with energy allowing our cells to perform an activity for only a short period of time.

Instructions:

- STEP 1)** Find a partner to work with
- STEP 2)** Take both of your resting pulse rates, for 15 seconds, and record them in the table below. Then calculate your pulse rate for one minute and record the data.
- STEP 3)** Take both of your resting breathing (pulmonary respiration) rates, for 15 seconds, and record them in the table below. Calculate your breathing rate for one minute.

DATA TABLE I (Resting) – PULSE & BREATHING RATES

	Resting Pulse Rate <i>before Activity</i>	
	<u>beats</u> 15 sec	<u>beats</u> min
Names		

	Resting Breathing Rate <i>before Activity</i>	
	<u>breaths</u> 15 sec	<u>breaths</u> min
Names		

STEP 4) You will perform an activity where you will continuously flex your muscles for one minute.

What do you predict will happen to your pulse and respiratory rates after 1 minute: _____

Immediately after this sitting activity take your pulse for 15 seconds while, at the same time, your partner is counting the number of breaths you take. Record this data in Data Table II.

THE SITTING TASK: While one partner watches the clock, the other partner places his/her back against the wall and slides down into a sitting position (knees at 90° angle) holding this position for 1 minute.

DATA TABLE II (After Sitting) – PULSE & BREATHING RATES

Names	Resting Pulse Rate <i>after Activity</i>		Resting Breathing Rate <i>after Activity</i>	
	<u>beats</u> 15 sec	<u>beats</u> min	<u>breaths</u> 15 sec	<u>breaths</u> min

STEP 5) Record your data from the shaded sections of Data Tables I & II in the spreadsheet on your instructors computer.

STEP 6) Record your % change in your pulse and respiration rates below.

My pulse rate changed by _____%

My respiratory changed by _____%

BONUS – How was your % change calculated? (*show your work!!!*)

STEP 7) When the entire class is ready, go to the stairwell and one partner will briskly go up and down a set of stairs for one minute.

What do you predict will happen to the pulse and respiratory rates after running the stairs for 1 minute: _____

Immediately after this stairs activity take your pulse for 15 seconds while, at the same time, your partner is counting the number of breaths you take. Record this data in Data Table III.

STEP 8) Switch roles and repeat Step 7.

DATA TABLE III (Stairs) – PULSE RATE

Names	Resting Pulse Rate <i>after Activity</i>		Resting Breathing Rate <i>after Activity</i>	
	<u>beats</u> 15 sec	<u>beats</u> min	<u>breaths</u> 15 sec	<u>breaths</u> min

How did you feel when finished with the sitting activity? _____

How much longer did you think you could perform this activity? _____

How did you feel when finished with the stairs? _____

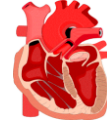
How much longer did you think you could perform this activity? _____

STEP 9) Record your group's data in the class Data Table on the computer in the Excel spreadsheet.

STEP 10) When all class data has been entered, record the following below

Average % change in pulse rate for **Sitting**: _____

Average % change in pulse rate for **Stairs**: _____

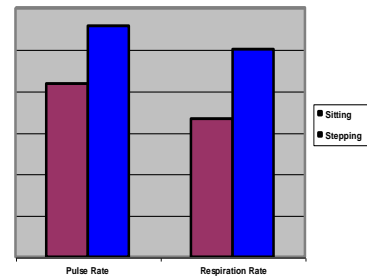


Average % change in respiration rate for **Sitting**: _____

Average % change in respiration rate for **Stairs**: _____



STEP 11) Using the example on the right as a guide, use the four **Average % Change** values from your class data to construct a bar graph on the following chart that will compare the average % changes of the pulse rates and the average % changes of the respiration rates for the *Sitting* and the *Stairs* activities. **Be sure to give your graph a legend and a title.**



Average
% Change

PULSE RATES **RESPIRATION RATES**

Analysis Questions

- 1) Were your predictions correct for the pulse and respirations rates? _____
- 2) If not, how were they different?

- 3) Which group's average change in *pulse* rate was greater, *Steppers* or *Sitters*? What was the percent difference between the two groups?

- 4) Which group's average change in *respiration* rate was greater, *Steppers* or *Sitters*? What was the percent difference between the two groups?

5) What cellular organelle provides the energy required for the activities we performed today?

6) While aerobic activities require additional oxygen for continued energy production, anaerobic activities can still occur without this additional oxygen. Based on your class data and observations, which activity is using aerobic energy production within your cells? Explain your answer.

7) Identify two other activities that use *aerobic* respiration and explain why.

1.

2.

8) Identify two other activities that use *anaerobic* respiration.

1.

2.

9) What might you do to make the activities performed today a more accurate study of aerobic and anaerobic cellular respiration. How would you make it a better experiment?
