# Lab 7: Aerobic Cellular Respiration

## Name and Course Section:

## Curiosity and Inquiry

“Does intensity (moderate versus strenuous) of exercise affect the CO₂ levels exhaled out of the human body and thus aerobic cellular respiration?”

## Formulating a Hypothesis

1. What is your hypothesis? Explain how and why moderate versus strenuous exercise may affect aerobic cellular respiration rate in humans.
2. Prediction #1: Will your data suggest a difference of CO2 levels between moderate and strenuous exercise?

## Testing the Hypothesis: Designing an Experiment

1. Design an experiment to test your group’s hypothesis/prediction. Below are things to consider when designing your experiment:

* What types of exercise are considered moderate? Strenuous?
* Should you do the exercises for the same duration of time?
* Should you collect CO2 for the same duration of time?

1. What are the **independent** and **dependent variables**?
2. What is the **control group**?
3. What is the **experimental group**?
4. What are reasonable (due to limited class time, resources, etc.) **sample sizes** for your control and experimental groups?
5. How many replications are reasonable in the control and experimental groups?
6. What are some physiological measures to record to ensure your subject is performing moderate or strenuous activity? In other words, what are some changes you notice in your body while you exercise?
7. Why does **heart rate** change during exercise and which organs are important for O2 acquisition?

Before moving on, check your experimental design with your instructor to gain feedback and edit the steps of your experiment.

## Testing the Hypothesis: Data Collection

1. Subject 1 Data Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TRIALS | Resting CO2 (PPM) | Resting beats per minute (BPM) | Moderate CO2 (PPM) | Moderate beats per minute (BPM) | Strenuous CO2 (PPM) | Strenuous beats per minute (BPM) |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |

1. Subject 2 Data Table (If time permits, collect data on another subject)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TRIALS | Resting CO2 (PPM) | Resting beats per minute (BPM) | Moderate CO2 (PPM) | Moderate beats per minute (BPM) | Strenuous CO2 (PPM) | Strenuous beats per minute (BPM) |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |

## Interpreting and Visualizing Your Data

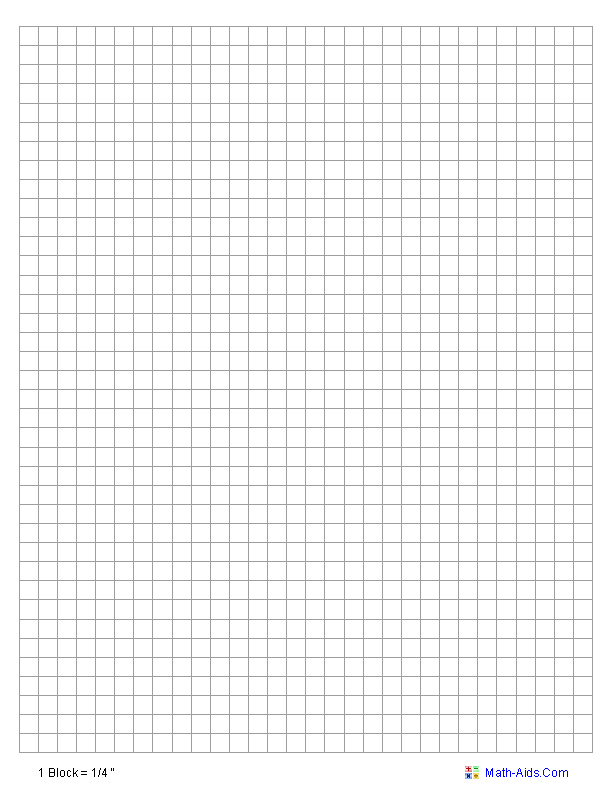
1. What are the **mean, mode, median**, and **standard deviation** of Subject 1’s data? (Your instructor will inform you if they wish for you to manually or automatically calculate the measures. Refer to Appendix 1 for instructions on using Google Sheets to calculate statistical measures to automatically calculate. However, you can use any program that you are most comfortable with.)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Resting CO2(PPM) | Resting beats per minute (BPM) | Moderate CO2 (PPM) | Moderate beats per minute (BPM) | Strenuous CO2 (PPM) | Strenuous beats per minute (BPM) |
| Mean |  |  |  |  |  |  |
| Mode |  |  |  |  |  |  |
| Median |  |  |  |  |  |  |
| Standard Deviation |  |  |  |  |  |  |

1. What are the mean, mode, median, and standard deviation of Subject 2’s data?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Resting CO2(PPM) | Resting beats per minute (BPM) | Moderate CO2 (PPM) | Moderate beats per minute (BPM) | Strenuous CO2 (PPM) | Strenuous beats per minute (BPM) |
| Mean |  |  |  |  |  |  |
| Mode |  |  |  |  |  |  |
| Median |  |  |  |  |  |  |
| Standard Deviation |  |  |  |  |  |  |

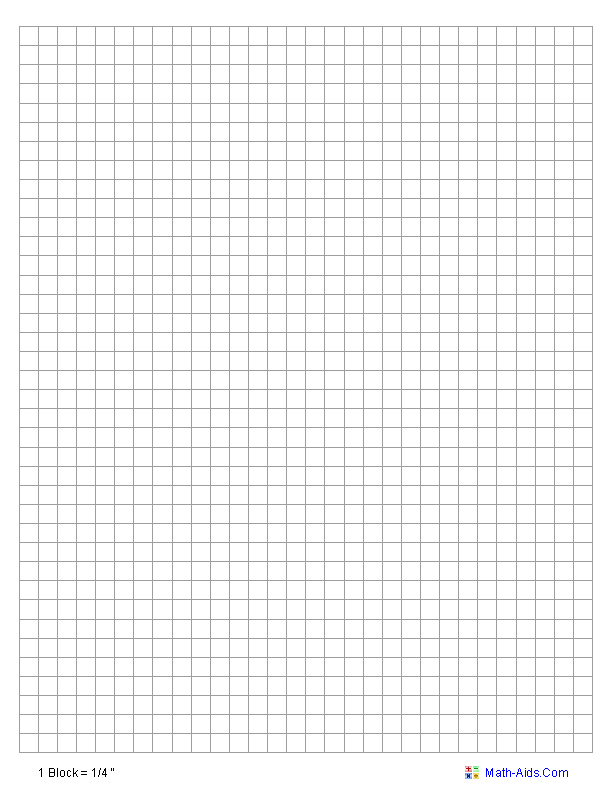
1. Which evidence would you use to determine whether the subject(s) performed moderate vs. strenuous exercise? Why?
2. Are the resting rates similar or different between the two subjects? Explain why there may be a difference, even if you are both resting.
3. Now plot the data that your group collected. Label the **X** and **Y axes** and choose the appropriate number scale for each axis. Graph the mean and the standard deviation bars. our instructor will inform you if they wish for you to manually or automatically create the graph. Refer to Appendix 1 for instructions on using Google Sheets to graphs with standard deviation bars. However, you can use any program that you are most comfortable with. *Helpful Tip: Apply your knowledge about****independent****and****dependent variables****when labeling the axes.*



1. Do you notice patterns between the independent and dependent variables? Explain the relationship.

## Interpreting and Visualizing Class Data

1. Now plot the data that the class collected. Label the X and Y axes and choose the appropriate number scale for each axis. Graph the % change mean and the standard deviation bars.



1. Do you notice patterns between the independent and dependent variables? Explain the relationship.

## Making a Conclusion

1. Do your results validate or reject your group’s hypothesis? Why?
2. What are some strengths and weaknesses of your experiment?
3. If you were to repeat this experiment, what would you do differently? If there were any inaccurate results, how would you avoid those next time?
4. Do your data display the same relationship as the class data? If not, describe the difference(s).
5. When analyzing the data, would you use your individual data or the class data to formulate your conclusions? Why?
6. Does the class data validate or reject your group’s hypothesis? Why?
7. If the purpose of aerobic cellular respiration is to convert chemical energy into usable energy, what is the significance of CO2 and O2 to aerobic cellular respiration in this experiment?
8. Based on the class data, what do you conclude about the effects of exercise intensity on CO2levels exhaled out of the body?
9. Based on the class data, what do you hypothesize are the effects of exercise intensity on aerobic cellular respiration rate in this experiment? Justify the hypothesis with an evidence-based argument.
10. In which organelle in the eukaryotic cell does aerobic cellular respiration occur?
11. Which of the following processes, glycolysis, citric acid cycle, or electron transport chain, produces the most ATP to support the muscles to perform different levels of exercise intensity?