



Analyzing your Data and Drawing Conclusions

As you begin to analyze the data you collected through experiments, make sure your team sets aside time to review the information with your Team Advisor and discuss how best to showcase your results and conclusions.

Within your Mission Folder, you should state whether your hypothesis was true or false, what you learned from your experiments and how your project could be improved.

Below you will find helpful questions for you and your teammates to consider as you review your data.

1. **Data Analysis:** Review data and results critically
 - a. Is the data complete and accurate?
 - b. Do I need to collect more data?
 - c. Did I make any mistakes in my research or experimentation?
2. **Summarize Data:** What is the best way to summarize the data?
 - a. Calculate an average of data collected?
 - b. Summarize the results as a ratio or percentage?
 - c. Display data clearly and concisely?
3. **Display Data as a Graph or Table**
 - a. Place independent variable on the x-axis of a graph
 - b. Place dependent variable on the y-axis of a graph
 - c. Label axes
 - d. Include units of measurement
 - e. Show each set of data in a different color or symbol
 - f. Include a legend
 - g. Convert data to show all units of measurement on the same scale

Now that you have analyzed your data, the last step is to draw your conclusions. Conclusions summarize whether the experiment or survey results support or contradict the original hypothesis. Teams should include key facts from your team's background research to help explain the results.

If the results of your experiment support that your hypothesis is **TRUE**, summarize how this occurred by comparing the relationship between the independent and dependent variables.

If the results of the experiments or surveys do NOT support the hypothesis and prove the hypothesis is **FALSE**, you should not change or manipulate the results to fit the original hypothesis. Simply explain why things did not go as expected. Scientists often find that results do not support their hypothesis. They use those unexpected results as the first step in constructing a new hypothesis. If you think you need additional experimentation, you should describe what you think should happen next.

Analyzing Your Data and Drawing Conclusions Worksheet

Instructions: Practice different ways to calculate and analyze data by completing the sections below.

1. This example shows data from an experiment testing whether spinach stays fresh longer in a new produce container versus the current cafeteria container.

	New Produce Container (length of time without mold)	Current Cafeteria Container (length of time without mold)
Trial 1	5 days	3 days
Trial 2	4 days	2 days
Trial 3	4 days	3 days
Trial 4	7 days	3 days
Trial 5	6 days	5 days

- a. Calculate the mathematical average or mean of the data above. The average is calculated by adding all of the measurements in one group, then dividing by the number of measurements.
- Average number of days for the new produce container

 - Average number of days for the current cafeteria container

- b. Find the median for the data above. The median is the value at the midpoint of the group. The easiest way to find the median is to first sort each group of measurement in order from the smallest to the largest.
- Median value for the new produce container _____
 - Median value for the current cafeteria container _____
- c. Find the mode for the data above. The mode is the value that appears most frequently in the group of measurements.
- Mode value for the new produce container _____
 - Mode value for the current cafeteria container _____
2. To calculate and analyze your data correctly, make sure all of the units of measurement are on the same scale. Practice converting the following units of measurements.
- a. Minutes to seconds
- 2 minutes 13 seconds = _____ seconds
 - 5 minutes 26 seconds = _____ seconds
 - 3 minutes 12 seconds = _____ seconds
- b. Liters to milliliters
- 0.5 L _____ mL
 - 2.4 L _____ mL
 - 1.6 L _____ mL



Your last step in your Mission Folder is to draw your conclusions, which summarizes whether your experiment or survey results support or contradict your original hypothesis. Summarize your conclusion below:

Now complete the following checklist, referencing your conclusion statement(s) for each question:

What makes for good conclusions?	Answer	
Did you summarize your results and use them to support the findings?	Yes	No
Did your conclusions state that you proved or disproved your hypothesis?	Yes	No
If appropriate, did you state the relationship between the independent and dependent variable?	Yes	No
Did you summarize and evaluate your experimental procedure, making comments about its success and effectiveness?	Yes	No
Did you suggest changes in the experimental procedure and/or possibilities for further study?	Yes	No

To determine whether you have written quality conclusions, you should have answered “Yes” to every question.

Let’s further test your familiarity with writing conclusions. Read the following results statements from an experiment testing and comparing the voltage of various batteries.

According to my experiments, the Energizer maintained its voltage (dependent variable) for approximately a three percent longer period of time (independent variable) than Duracell in a low current drain device. For a medium drain device, the Energizer maintained its voltage for approximately 10 percent longer than Duracell. For a high drain device, the Energizer maintained its voltage for approximately 29 percent longer than Duracell. Basically, the Energizer performs with increasing superiority, the higher the current drain of the device.

The heavy-duty non-alkaline batteries do not maintain their voltage as long as either alkaline battery at any level of current drain.



Use the word bank to fill in the blanks for the following statements using the statement above:

1. My _____ was that Energizer would last the longest in all the devices tested. My results did/did not _____ my hypothesis.
2. My hypothesis was _____, for my results prove that heavy-duty alkaline batteries do not maintain their voltage as long as either alkaline battery at any level of current drain.
3. The dependent variable, _____, maintained its voltage for approximately a three percent longer period of time (the independent variable) than _____.
4. To _____ my study, I might involve testing batteries at different temperatures to simulate actual usage in very cold or very hot conditions.

Source: <http://www.sciencebuddies.com>

Duracell battery	further	Energizer battery
hypothesis	support	correct

Analyzing Your Data and Drawing Conclusions Worksheet

Instructions: Practice different ways to calculate and analyze data by completing the sections below.

- This example shows data from an experiment testing whether spinach stays fresh longer in a new produce container versus the current cafeteria container.

	New Produce Container (length of time without mold)	Current Cafeteria Container (length of time without mold)
Trial 1	5 days	3 days
Trial 2	4 days	2 days
Trial 3	4 days	3 days
Trial 4	7 days	3 days
Trial 5	6 days	5 days

- Calculate the mathematical average or mean of the data above. The average is calculated by adding all of the measurements in one group, then dividing by the number of measurements.
 - Average number of days for the new produce container **5.2 days**
 - Average number of days for the current cafeteria container **3.2 days**
 - Find the median for the data above. The median is the value at the midpoint of the group. The easiest way to find the median is to first sort each group of measurement in order from the smallest to the largest.
 - Median value for the new produce container **5 days**
 - Median value for the current cafeteria container **3 days**
 - Find the mode for the data above. The mode is the value that appears most frequently in the group of measurements.
 - Mode value for the new produce container **4 days**
 - Mode value for the current cafeteria container **3 days**
- To calculate and analyze your data correctly, make sure all of the units of measurement are on the same scale. Practice converting the following units of measurements.
 - Minutes to seconds
 - 2 minutes 13 seconds **133 seconds**
 - 5 minutes 26 seconds **326 seconds**
 - 3 minutes 12 seconds **192 seconds**
 - Liters to milliliters
 - .5 L **500 mL**
 - 2.4 L **2400 mL**
 - 1.6 L **1600 mL**



Your last step in your Mission Folder is to draw your conclusions, which summarizes whether your experiment or survey results support or contradict your original hypothesis. Summarize your conclusion below:

Students' answers will vary.

Now complete the following checklist, referencing your conclusion statement(s) for each question:

What makes for good conclusions?	Answer
Did you summarize your results and use them to support the findings?	Yes / No
Did your conclusions state that you proved or disproved your hypothesis?	Yes / No
If appropriate, did you state the relationship between the independent and dependent variable?	Yes / No
Did you summarize and evaluate your experimental procedure, making comments about its success and effectiveness?	Yes / No
Did you suggest changes in the experimental procedure and/or possibilities for further study?	Yes / No

To determine whether you have written quality conclusions, you should have answered “Yes” to every question.

Let's test your familiarity with writing conclusions further. Read the following results statements below from an experiment testing and comparing the voltage of various batteries.

According to my experiments, the Energizer maintained its voltage (dependent variable) for approximately a three percent longer period of time (independent variable) than Duracell in a low current drain device. For a medium drain device, the Energizer maintained its voltage for approximately 10 percent longer than Duracell. For a high drain device, the Energizer maintained its voltage for approximately 29 percent longer than Duracell. Basically, the Energizer performs with increasing superiority, the higher the current drain of the device.

The heavy-duty non-alkaline batteries do not maintain their voltage as long as either alkaline battery at any level of current drain.

Use the word bank to fill in the blanks for the following conclusion statements using the results statement above:

1. My **hypothesis** was that Energizer would last the longest in all the devices tested. My results did/did not **support** my hypothesis.
2. My hypothesis was **correct**, for my results prove that heavy-duty alkaline batteries do not maintain their voltage as long as either alkaline battery at any level of current drain.
3. The dependent variable, **the Energizer battery**, maintained its voltage for approximately a three percent longer period of time (the independent variable) than **the Duracell battery**.
4. To **further** my study, I might involve testing batteries at different temperatures to simulate actual usage in very cold or very hot conditions.

Source: <http://www.sciencebuddies.com>

Duracell battery	further	Energizer battery
hypothesis	support	correct