Guide to Lab Reports and the Scientific Method

Step of the Scientific Method	Explanation of the Step
Question	Your research question or problem needs to be phrased as a question and related to the current science content. **Example: "Under what color light do plants grow the tallest?"**
Background Information	The background information is the research your do about your question. This section should: 1. inform you and the reader about the experiment. 2. fully address all parts of the purpose question. Search many trusted sources for your information. Websites that end in .gov, .edu or .org are good. Sites ending in .com are usually commercial sites and less informative. 3. be written in the student's own words using complete sentences 4. be from more than one source. 5. not include personal or possessive pronouns.
Hypothesis and Variables	This section has two parts. **1.** The **hypothesis** is your predicted answer to the question. The hypothesis should be well written. It needs the following five parts. • is testable (You should be able to test your prediction in our lab.) • tries to answer the question (Your hypothesis should answer the question.) • is written as an "If…then…because" statement. • Includes an explanation of the thinking behind it. (This is your "because part) • avoids using "I" **Example: For the above question** "If ten plants are grown under four different types of light then the ten plants under the blue light will grow the tallest because many plant leaves absorb more blue light and reflect more green light." **2. Variables:** You need to identify the following 3 variables and give a detailed account of how you used them in the experiment. **a.** Independent variable (IDV) = The variable you change on purpose to see what will happen. **b.** Dependent variable (DV) = The variable that may or may not respond or change because the independent variable changed. You usually measure this variable. Make sure to tell how you will collect enough data to answer the question. **c.** Control variable (CV) = State at least three variables that you control so that they don't affect the dependent variable. **Example: For the above question** 1. IDV = "I will manipulate the color of light for the IDV by growing plants under 4 different colors of light including green, red, blue and white." 2. DV = "I will measure the height of each plant everyday for two weeks to determine how the DV changed. By using 10 plants per group I will have many repeated values for each light type. Therefore, I will have a good idea if each color affects all 10 plants equally or not." 3. CV = "Several variables were controlled in the experiment. Each plant had 100ml of soil, the same light intensity of 60 watts, the plants were put in the same location near my bedroom window and were each given 10ml of water every 3 days.

<table>
<tr><td></td><td></td></tr>
<tr><td>Materials and Methods</td><td>This section has two parts.
1. Materials list: Give a complete bulleted list of what you used in the experiment. Make sure to include measurements and quantities of materials.

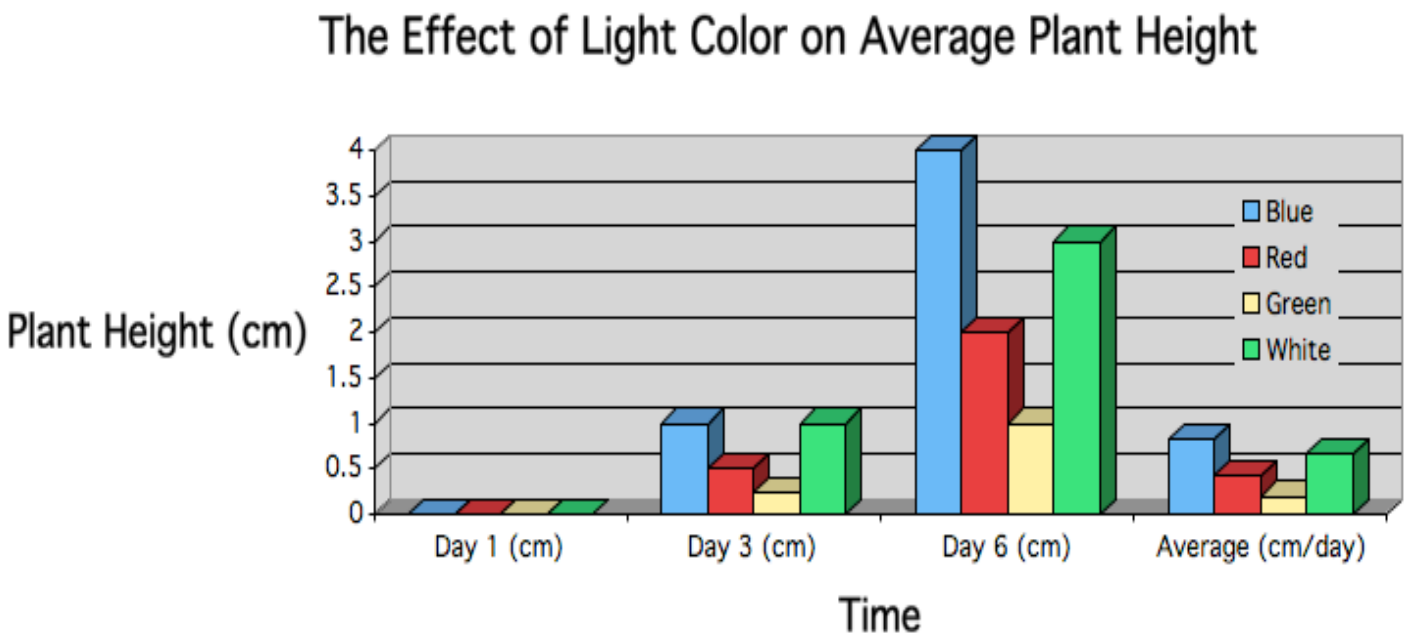
Example: For the above question
"Materials List
• Forty 100ml plastic containers
• Four liters of potting soil
• Etc…"

2. Procedure: This is a written list of steps for the experiment that, if you followed them exactly, then you would precisely repeat the experiment. It should also be void of personal or possessive pronouns.

Example: For the above question
"Procedure
1. First place all forty 100ml plastic containers on the ground.
2. Open the bag of soil and measure out 100ml of soil into each pot.
3. Open the bag of lettuce seeds and place 2-3 seeds into each container.
4. Etc."</td></tr>
<tr><td>Data (tables, graphs)</td><td>This section has at least one table that gives data for one type of graph.
Your table should have:
• A clear title that describes the data within the table
• Qualitative and quantitative data about the experiment
•
Your graph should be
• neat, with ruler-drawn or computer drawn lines.
• the best type to present the data collected (for example; a line graph is best to show change over time.)
• correctly titled and axes labeled.
• made with the correct scale and interval to best display the data.

Example Table: For the above question

The Effect of Colored Light on Average Plant Height
<table><tr><th>Light Color</th><th>Day 1 (cm)</th><th>Day 3 (cm)</th><th>Day 6 (cm)</th><th>Average (cm/day)</th></tr><tr><td>Blue</td><td>0</td><td>1</td><td>4</td><td>.83</td></tr><tr><td>Red</td><td>0</td><td>.5</td><td>2</td><td>.42</td></tr><tr><td>Green</td><td>0</td><td>.25</td><td>1</td><td>.2</td></tr><tr><td>White</td><td>0</td><td>1</td><td>3</td><td>.67</td></tr></table></td></tr>
</table>

Data (tables, graphs) (continued)	**Example Graph: For the above question** 
Conclusion	The conclusion is your final section where you analyze your results, reflect on your hypothesis and answer the question. It should have **six** parts. 1. Give a detailed account of how the IDV affected the DV. 2. Accept or reject your hypothesis and tell why **using data form the experiment**. It is recommended that you restate your hypothesis. 3. Answer the question from the beginning of the lab. Support your claim with **evidence** from the lab**.** Give scientific reasons to explain the experimental results. Use new vocabulary and elaborate your understanding. 4. Discuss any errors in your procedure that could have caused incorrect data. Did you collect enough data to answer the question or was more needed? 5. Give a detailed account of improvements you could make to the experiment that would lead to better data and possibly a more accurate answer. 6. Describe possible extensions you could make to this experiment that would lead to further investigations.

Conclusion (continued)	**Example: For the above question** "The effect of light on plant height was investigated through this experiment. The data shows that plants grown under blue light had a faster growth rate of .83 cm/day than plants grown under red, white or green. The plants under white light grew second tallest at .67 cm/day while those under red light grew only .42 cm/day. The plants grown under green light grew the least at .2 cm/day. The results support the hypothesis. As stated before it was predicted that "If ten plants are grown under four different types of light then the ten plants under the blue light will grow the tallest because many plant leaves absorb more blue light and reflect more green light." The data supports this hypothesis because the plants grown under blue light grew the tallest and fastest. Therefore the hypothesis is accepted. Plants grown under blue light grew the fastest and tallest because the plant pigment chlorophyll easily absorbs light in the blue and orange wavelengths. The greatest absorption is in these two areas of the electromagnetic spectrum. The least amount of absorption is in the green wavelengths of light, therefore, it is logical that plants would grow poorly under green light. This was shown in the experiment with the average plant growth in green light performing the lowest of all light color types. The data from the experiment supports what is known scientifically and what has been shown through other's experiments. During the experiment there were several steps that could have led to incorrect data. The red light bulb was not 60 watts in power and was only 55 watts, which could have been the reason why the plants in the red group grew slightly less than the blue group. Additionally, the plants were grown near a window and the white light groups were exposed to about 2 more hours of sunlight than the other groups. Growing ten plants per group was sufficient to get an accurate average of daily plant growth. A few plants per group died but there were 8-9 other plants that could be used for the daily average. If the experiment were performed again then all of the light bulbs should be of the same wattage (60). The plants should have ideally been place in separate boxes isolated from each other and from natural sunlight. Then the plants would only have been exposed to the color of light that was chosen for them. While performing this experiment there were several additional questions that would be interesting to test. Only four experimental colors of light were tested. It would be interesting to add more colors of light like orange and purple to see if these produced higher growth rates. It would also be interesting to test if algae and other photosynthetic organisms also prefer blue light. Algae could easily be collected and grown under different colored lights. If they also grew best under blue light then this may suggest that they share a common ancestor in the past."
Share	Find a way to share the results from your experiment. Examples of sharing: • Speech • Video • Presentation • Website • Poster • Report