

Formal Lab Report Guideline/2015 (last revised Fall 2015)

All formal lab reports must include a heading on the top left of the first page which includes: name, date, title of lab. A 12-point readable font should be used. The report should be single spaced with generous margins (1- inch). Double spacing should be used between each section. The entire report should be written in third person passive voice. The following headings should be clearly visible with the required information reflected within each category.

PLANNING:

Background/Introduction: Some background information about the topic of the lab should be included to introduce it. If a source is used, it should be cited. In this section, you will describe what instructions were given. You will state the objectives of the investigation, why you are performing the experiment, and why it is important. It will include the ***purpose or research question***, and ***hypothesis***.

Variables: If it is a *controlled* lab, identify relevant variables and explain methods for the effective control of variables.

Independent: *Identify the variable you are manipulating and describe how you will manipulate it.*

Dependent: *Identify the responding variable and describe how it will be measured.*

Constants: *Describe ALL OF the variables and conditions that will be held constant throughout the experiment and describe how each will be controlled.*

Materials: Provide a list of all the equipment and chemicals used in the experiment, including the proper sizes of the glassware used, brand of instrumentation, concentration of the acid, etc.

Methods: Give a detailed, step-by-step description of **how, when, and where** this experiment was conducted. Write it in such a manner that another scientist could replicate the lab exactly. Numbered steps are recommended, but paragraph form can work as well. Remember to use third person passive voice. If you are designing the experiment, you must explain how you determined **what was considered sufficient and relevant data**. What is sufficient will depend upon the nature of the investigation and the time available to the student.

DATA COLLECTION AND PROCESSING:

Data: Present all data in clearly identified tables. *Both* number and title the tables. Be sure to include units (in column headings) and record uncertainty of the instrumentation. Underneath each table, briefly describe the results. This should just take a sentence or two. (Do not explain why, simply summarize.) Raw data should be in separate tables from processed data.

Calculations: Show *only one* calculation of each type used in interpreting the results. It is necessary to show the *generic formula* for the calculation followed by a *specific example*. Describe where the values in the specific example were pulled from. Be sure to consider significant figures when processing data. (if the data is measured and not counted) When calculating an average value from repeated trials, don't average the raw data, instead, calculate a result from each trial. Then, average the results from each trial to get a final experimental average.

Graphs: If it aids in interpretation of the data, one should provide a labeled, properly scaled graph. Scaling should be suitable, and units labeled. The independent variable should be on the **x**-axis and the dependent on the **y**. The proper type of graph should be chosen. For example, if both variables are continuous, a point graph should be used.

A best-fit curve should be chosen over a connection of the data points. Only data that has been PROCESSED should be graphed. Error bars should be incorporated to reflect the uncertainty of the data.

DISCUSSION, EVALUATION AND CONCLUSION:

Discussion: Begin with a couple of “warm up” sentences then discuss what happened in the lab and the outcome. (e.g., What reaction occurred? What did you see? How did the independent variable affect the dependent variable? Why do you think so?) Tell me what your observations mean and what your data means (what you saw/what you measured) and describe how you *analyzed* the data to form a conclusion. Explain what the results mean. Show that you have a clear understanding of what occurred in the lab. This should be well-written and new paragraphs should be incorporated as necessary. **This is the heart of the lab and often where a good lab is distinguished from others. It is important to discuss the broader significance of your findings and consider results in the context of relevant literature or accepted scientific understanding.**

Evaluation: In this section, explain how confident you feel with the outcome of your lab and why is this so. Suggest weaknesses, uncertainties, or losses that occurred during the experiment. Describe how these uncertainties would change or *if* these uncertainties would change the outcome. Include suggestions as to what you would do differently if the lab were to be repeated. Refrain from avoidable human error. Suggestions of things to evaluate could include: procedure, use of equipment, limitations of equipment, management of time, and quality and relevance of data.

The format for this section should include at least three paragraphs. Each paragraph should include (1) possible source of error, uncertainty, or cause of loss, (2) followed by how that said error could have affected the end result, and (3) what you would do in the future to avoid this stated error.

If possible, provide a statistical analysis of the accuracy of your data. (e.g., percent yield or percent error)

Conclusion: State clearly whether or not the purpose of the experiment was achieved and whether or not the hypothesis was validated. Briefly support this statement with reference to percent yield, percent error, trial variation, or significant outcome. You may also opt to discuss extensions to the lab and suggest further areas of study. This section should not be more than a few sentences long.

OVERALL IMPRESSION

You will also be evaluated for your **OVERALL IMPRESSION**. Some of the items evaluated will be:

- Formatting (Is it well organized and are sections CLEARLY labeled? Did you space correctly?)
 - Tense (Did you stay in 3rd person passive voice...“The stockings were hung by the chimney with care.”)
 - Clarity (Are you clear and to the point?)
 - Terminology (Did you use proper scientific language?)
 - Spelling
 - Grammar
 - Sources: Properly site all sources used *within the text* of the lab report. (For this format reference, I used a combination of AP guidelines, IB guidelines, and the Signature School Science department.)
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PERSONAL SKILLS

The following **PERSONAL SKILLS** criteria are **EXPECTED** of each student for every lab. **Deductions** will be taken from the lab report if these criteria are not met.

- Be methodical in the use of a range of techniques and equipment. (read instructions, watch what is demonstrated, and follow directions)
- Consistently collaborate and communicate in a group situation and integrate the views of others.
- Pay attention to safety issues and show due regard for the environmental consequences of his or her actions and academic integrity.