ROCKET DESIGN REPORT

You will use these guidelines to write this report. You will take a science class in college and your professors will expect similar criteria. Learn it now. Read, highlight, and underline these pages at least twice.

NUTS AND BOLTS

Individual reports. Each student will write an individual report, including individual drawings photos, diagrams, data tables – these should not be shared between partners.

Fonts. Double spaced, 1" margins. Fonts must be: black, 12 pt, and Times New Roman or Cambria, only. Any report submitted in Comic Sans will be given an automatic zero.

Footnotes. You need to footnote thoughts not your own. Your electronic footnotes at the bottom of each page should follow the format, author or organization, publication or date last updated, web page title, format, Internet address, date accessed. Include a list of your sources in order in a bibliography as the last page.

Wikipedia. (2015, Aug.) Institute of EE Electronics Engineers [Online]. Available: http://wikipedia.org/EENG. [Accessed Sept.9 2010]

Data Tables, charts, and equations. Data tables must be typed, numbers in data tables must be center justified, in bold font following the guidelines below. Data tables and charts must be labeled with the following format in bold '**Figure #: Title**' below each table in the report, and center justified. There must be no other text around a data table or chart, Figure numbers must be sequential with all other figures in the report. For the entire report, pictures, tables, and charts should be labeled 'Figure.' If the first piece of graphical information is a graph, label it 'Figure 1.' If the second piece of graphical information is a table, name it 'Figure 2' not 'Table 1.'

Passive voice in past tense. Use the past tense as the experiments are complete by the time you begin writing. Use the passive voice, do not use 'I.' "The experiment was completed," is acceptable, while "I did the experiment," is unacceptable.

Handing it in. Rocket reports must be emailed as a PDF with the file format as follows: LastName_RocketName. Example: 'Darlington_Oxcart'. Errors in this process will not be accepted. Rocket reports are due by email (kjdarlington@galwycsd.org) at 10:00 PM the day before the last school day before Christmas break. Unless told otherwise

WRITING STYLE

You are teaching future rocket builders. You don't get credit for a new discovery until other scientists can reproduce your results based on your report. After reading your report, someone from your class should be able to read your report, understand it, and reproduce your results.

Be direct and concise. Don't use bold words, all caps, colloquialisms, hyperbole, or be overly verbose. Big words are okay, but not at the expense of clarity. As an example, it would be okay to say, "The sample was levigated, then dissolved in water," because levigated means to grind into a fine powder and is appropriate in this context. But it would not be okay to say, "There was visible vapors having their provenance in ignited carbonaceous materials," because it's verbose, confusing, and sounds like you are showing off. In this case just say, "Smoke rose from the sample."

Here's an example of a something typical that could be better:

> *The weather this launch was relatively normal, other than being abnormally warm. The first launch was the one ball- gutter fin rocket. For some reason, it did not perform nearly as well as the rocket tested on the first launch day. However, the velcro fins worked as planned. Detaching on impact and not breaking. These fins may have also been a factor for why that rocket didn't go as far. The second launch was the two ball gutter fin rocket. It did okay, but not as well as hoped or expected. The third launch was just not good. The plexi glass design was not a success by any means.*

My comment to them was:

> *You are using a lot of descriptive words here, which might seem okay, but is coming across as*

unscientific and vague. "It did okay . ." might mean something to you, but to someone reading this report, it doesn't really tell them anything useful they can use and work with. Better would be to dig into the results, and describe the specific parts of the rocket that performed well (and didn't) and suggest reasons why, and ways to do better.

Show not tell: that is, show in words exactly what you did, don't generally describe what you did. More detail, more detail, more detail. If you are describing how you build your rocket in design and testing, include measurements, pictures, etc. More detail the better. This is scientific. Include as many pictures of what you are talking about as possible. You will be marked down if you don't have pictures, especially in the section where you describe how to build your final design.

In discussing what went wrong in an experiment, know that it's ok to get 'bad' results providing you were not careless. You must also suggest ways to improve on the experiment if you could do it over again.

The role of your lab notebook. You will use your lab notebook extensively to outline your designs, make launch notes, and write down anything you need to go in your final report. You should have it and a pen with you at all times to write down anything that's possibly useful for your final report. More on this in the **Testing and Development Section.**

Double check the rubric. Pay special attention to the 'Lab Report Rubric' and 'Engineering Design Rubric' when you write and rewrite your report. Your grade will be determined by how well you adhere to these guidelines. Students who pass this report typically rewrite/revise their report three or four times.

SECTIONS OF YOUR REPORT

Each of the following sections will have its own 'cover page', in bold, horizontally and vertically centered on a single sheet paper: **PROJECT STATEMENT, LITERATURE REVIEW, TESTING AND DEVELOPMENT, ROCKET DAY CONCLUSION,** and **LAUNCH TEAM.**

COVER PAGE
Title, rocket name, date submitted, maximum launch distance. Only include your name in the report if you are okay with your name being posted online, as all reports will be posted in the Archive at the Natural Philosophers unless you say otherwise.

PROJECT STATEMENT
State the purpose of the rocket project in your own words. Your purpose is to build on the rocket constructing knowledge of students who came before you and build a water rocket to fly a maximum distance. Your constraints are that it must be made from a plastic soda bottle and cannot contain anything that could produce shrapnel if a rocket explodes and fails. Fuel is water, only. No electronics are allowed.

LITERATURE REVIEW
In this section, you will summarize the things you learn from reading past-year's students design reports and resources online.

Using your best judgment, in five separate paragraphs, describe the pros and cons of different fin shapes, nose cones, how pieces were secured to the bottle, an ideal mass, and general lessons learned in rocket building. Be concise, but spare no details. If you are going to pursue a two tank design, add a sixth paragraph outlining ways to splice two (or more) bottles together.

Be sure to include citations of all of the information you are collecting. If it isn't your idea, it needs a citation or it's plagiarism.

TESTING AND DEVELOPMENT
This section will be based entirely on the notes your lab notebook. Each Mission is broken up into different missions each with its own date, with each mission representing a different launch day. In your report, start each section with the following title at the top of the page, in bold: **Mission #: Year - Month, Day**.

I strongly encourage you to check the 'Flying Lady' report for the level of detail I'm looking for in launches and what I'm describing below.

Each mission with have three subsections each with its own heading in italics, using Mission 1 as an example: *Mission #1: Preparation, Mission #1: Results, Mission #1: Problems to Solve for Next Time*.

Mission preparation will explain to the reader what specific design elements you are testing on that mission day, or solutions to problems you discovered on the

previous day, and give a general outline of what your bottle design is like that day. Include all details a reader would need to recreate your design on that day.

'Missions results' will explain what happened on that mission day – rocket distances, wind and weather, unforeseen environmental factors and launch issues, launch pressure – everything you can think of that influenced your launch. Use data tables to show distances and organize data as you see fit. Make notes in your lab notebook that you will need to write this section.

'Mission Problems to Solve for Next Time' will explain the general lessons learned from that mission that will inform the design changes you will make for the next mission date. Describe any damage your rocket suffered, how design elements (fins, weight, nose cone, etc) performed. Talk about what you learned because these elements either worked well, or performed poorly. Using the performance data from each launch day, talk about any additional research you need to do to solve any problems that cropped up. Talk about your plan to fix these problems, or improve your design overall. Once this research is done, talk about how you are going to redesign your rocket specifically, including diagrams, measurements, list of materials, how to put it together, etc.

Repeat this pattern for every day that you launched. Be sure to include citations for design ideas that were not original thoughts of your own. Include descriptions of everything – fins, nosecone, how it was all secured together – everything.

Mission Operations Summary. Include a table summarizing all of your launch data in one data table. Describe any trends you see in your rockets performance as the project evolved.

ROCKET DAY CONCLUSION

Summarize the most important lessons you learned during testing and development. Describe how these lessons led you to your final design.

Take the reader through the final design by describing – in detail, including measurements, materials used, photos / diagrams – how to build your final rocket design.

Include any advice you would give to someone embarking on this project. What do you wish someone would have told you before you started?

LAUNCH TEAM

What your role is as part of the launch team and a detailed description of your responsibilities. For example – if you are on the air team and are in charge of operating the air compressor, you need to write instructions about how to do so. It is not enough to just write, "This group was in charge of delivering compressed air to the launcher."