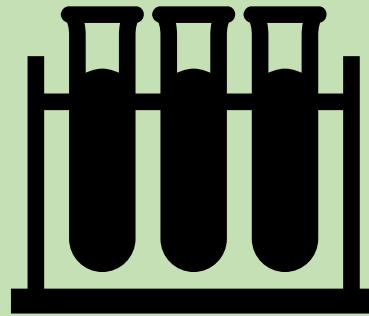


Experimental Design

William Woodley
University of Alberta



(Adapted from a presentation by Stephen Lane)

Rubric

	Fail	Pass	Passed Y/N
Title	No title provided (or very generic title provided).	Title is descriptive & gives the reader a very clear idea of what the project is about.	P
Introduction	The problem to be answered is unclear. Background for the experiment is weak or missing, and hypothesis is untestable or unfalsifiable.	Describe the problem to be answered. Provide background for the experiment and give a testable hypothesis/prediction.	P
Materials/ Equipment/ Set up	Materials/equipment/resources are missing or listed inaccurately; set up is very poor/absent.	All major materials/equipment/resources are clearly listed; set up is clearly described and diagrammed, where appropriate.	P
Design / Error & Bias	Design shows poor understanding of measurement difficulty, and does not discuss strategies to ensure accurate data/results.	Design predicts specific challenges with collecting reliable data, and discusses strategies to mitigate these.	P
Timeline & Procedure	Timeline is vague or missing; procedures are lacking or do not accurately list the steps of the experiment.	Timeline is detailed; procedures are listed in clear steps & are complete; investigation could be imitated.	P
Chronicling Strategy	Vague or infeasible discussion on how data & observations will be recorded and organized.	Specific & feasible discussion of how project (notes, observations, data, photos) will be recorded & organized.	P
Organization & Format	Major readability, formatting, or organizational issues.	No major readability, formatting, or organizational issues.	P
Mechanics	Many large errors in spelling, punctuation and/or grammar, or in places significantly affecting reader comprehension	Minor or no errors in spelling, punctuation and/or grammar. Reader comprehension not significantly affected.	P
Hazard Assessment	Vague or incomplete hazard assessment and review of safety considerations.	Careful & complete hazard assessment and review of safety considerations.	P
TOTAL:			P

If you pass each criterion, you get 100%, and you do not need to submit a final version.

Rubric

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Organization & Format	Major readability, formatting, or organizational issues.	No major readability, formatting, or organizational issues.	F
Mechanics	Many large errors in spelling, punctuation and/or grammar, or in places significantly affecting reader comprehension	Minor or no errors in spelling, punctuation and/or grammar. Reader comprehension not significantly affected.	P
Hazard Assessment	Vague or incomplete hazard assessment and review of safety considerations.	Careful & complete hazard assessment and review of safety considerations.	P
TOTAL:			F

If you fail even one criterion, you fail the draft, and will need to submit a final version.

Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.
- Let's look at some examples.

Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.

Light Diffraction



Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.

Light Diffraction

Main idea present, but not descriptive enough!



Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.

Measuring Hole Size Using Light Diffraction



Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.

Measuring Hole Size Using Light Diffraction

States what was measured and how.



Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.

Transmission Patterns of Quantised Coherent Electromagnetic Pulses Passed through Dual Discrete Symmetric Optical Barriers



Title

- The title briefly states what you worked on, and helps somebody decide if they want to read your work.
- It should be descriptive, but simple, not vague, obvious, or long.

Transmission Patterns of Quantised Coherent Electromagnetic Pulses Passed through Dual Discrete Symmetric Optical Barriers

Too many big words! This is hard to understand and boring to read.



Introduction

- The Introduction prepares the reader for the topic. Why is the topic important? How did it come to be important?

Ancient Greeks thought the Earth was round, and were trying to figure out ways to measure its size without going into orbit or having aircraft. Along comes Eratosthenes...

- Even with this brief example, the reader can see why this topic is important, and might even be thinking of how they could deal with it.
- What background do you already know about this topic?

Introduction

- What are you going to test? What are your predictions? Your predictions should be measurable and falsifiable.
- Karl Popper wrote in 1934 that “any theory that cannot be proven false is scientifically useless.” One of the major criticisms levelled at early string theory was that there was no experiment that could disprove it.
- You should frame your experiment in a way that makes it scientifically valid.

Design

- Taking reliable data is difficult; the universe hates being measured (observer effect, chaos theory, etc.).
- What factors will be difficult to control? How will you attempt to control them? If you take measurements, how do you know you can trust them? Will you take multiple measurements? Will you take measurements in different ways, or in different conditions (varying the control factors)? What about the inaccuracy of your measurements?
- Even if you do not have a rigorous plan to account for everything, make a note to acknowledge the possible errors or biases in your design.

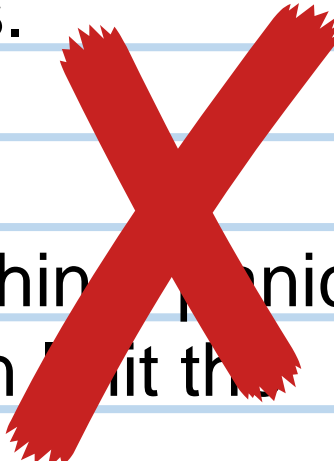
Materials

- Make sure you will have all the materials you will need.
- Draw a diagram of your set-up.
- Briefly explain how the set-up will work.

Timeline

- **16 February:** Submit experimental design for easy marks.
- **9 March:** Just chill.
- **16 March:** Think about taking initial data.
- **23 March:** Try taking initial data, realise I forgot something, panic.
- **29 March:** Pull an all-nighter, internet goes down when I hit the submit button at 1:59 pm.

Timeline

- **16 February:** Submit experimental design for easy marks.
 - **9 March:** Just chill.
 - **16 March:** Think about taking initial data.
 - **23 March:** Try taking initial data, realise I forgot something in my protocol.
 - **29 March:** Pull an all-nighter, internet goes down when I try to submit the report. I finally submit the report at 1:59 pm.
- 

- Give a procedure of your project with a timeline of what you hope to get done each week. This will help both you and me keep track of your progress. If you finish too early, maybe your project is too simple. If you are not on track to finish on time, maybe it is too ambitious.

Chronicling

- If your data gets lost, that can be very bad. If you forgot what data goes with what set of control variables, that can also be very bad.
- Describe what data you will take and how you will organise and store it.
- Will you use handwritten notes in a lab book? Organised spreadsheets in Excel?

Organisation

- Make sure all of the pieces listed on the rubric can easily be found so that you can get marks for all of them.
- Make sure your font size and colour are legible, and that your diagram is clear.
- Do not do anything weird with the document layout, the margins, or paragraphs that make your work unreadable.

Mechanics

- You are not marked for your English. However, if I cannot follow what you have written because of excessive typos or a confusing flow of ideas, I cannot give you marks.
- A few mistakes is fine, but you should generally make use of spell-check and grammar-check to avoid major or recurring mistakes.