This is my paper

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# Abstract

This is my abstract. The abstract should be approximately 100 words long. It should be concise. It should briefly describe what you have done and give key results and perhaps the value of these results. It should not have references. The abstract should give the reader an overview of the paper. We did this. This is why we did it. This is what it means. This is a great experiment. Here is why it was so important. Here are the highlights.

# Introduction

The purpose of the introduction is to provide the reader of an overview of what you have done and what is the **question** you are answering. It should start with putting your investigation into context of what others have done, briefly what the background is so that you are setting up to show why your measurements are valuable to this community which has some interest in your investigation. You may be describing (briefly) the theory. Make certain that you appropriately reference these works such as this great paper[[1]](#endnote-1).

The introduction has another purpose: grabbing the interest of the reader. Not only does the reader of the introduction have to find out what has gone before, but they need to know why that is physically interesting. You should NOT be doing a book report. Use references to direct the reader to sources in which they describe the background context in greater detail.

Typically, there will not be any figures or tables within the introduction.

Reading a 2000 word paper should not be too bad either because 2000 words corresponds to only approximately 4 pages or so. Hopefully, when you write a paper you will be careful with misspellings and you will pay attention to grammer (did you catch the problem?). One of the jobs that you have as author is that you must make the paper readable. You have to make it easy on the author by being clear. This will require re-reading your paper, editing it for clarity. Remove any information that is not pertinent or useful to your question. This latter can be difficult because sometimes there are interesting things we want to describe. However, it is the job of the author to remain on topic and focused.

# Experiment

The experiment section of the paper should describe the apparatus used in the investigation. It should describe how that apparatus is arranged. It should have one or more very clear figures showing the experimental set-up. These must be referenced in the text. For example, see Fig. 1 for a sample diagram. These diagrams have to have a professional appearance. The figure should be captioned so that one could look at the figure and understand the figure in isolation to the paper.

LASER

N

L1

L2

D

Figure - Experimental schematic. Gas at the expansion pressure expands through the nozzle (N) into the vacuum chamber. The laser beam is focused in the center of the expansion by lens $L\_{1}$. Light scattered by the clusters is collected by lens $L\_{2}$ and imaged on the detector D.

The figure should show critical layout of the experiment. Sometimes a schematic is appropriate. Sometimes, a photograph may be preferable, though that must have labels photo-shopped on it and must be better than simply a cell phone photo. My personal preference is a schematic. It may be that you need to use some sort of CAD or 3D program to generate the appropriate figure.

One should not include data or analysis within the experiment section. That is reserved for a later section of the paper. It may be that your experiment bears a striking resemblance to someone else’s. This should be referenced[[2]](#endnote-2).

You need to describe the data acquisition procedure. Describe the conditions used when the data was acquired. A reasonably intelligent reader should be able to reproduce your experiment from your description and figure.

When writing it is also necessary to consider segue between paragraphs and sections. At the end of each section you should be setting up the idea for the next paragraph or section. In each paragraph, try to keep to a single point or narrow group of related points.

Figure – This is a graph of the raw data. The vertical uncertainty is within the size of the data markers. The horizontal uncertainty is shown on the chart.

# Results and Analysis

In the results section you start by describing the data you have acquired. This may need a table such as in Table 1. It may be better to present the data graphically (see Fig 2). Notice that the figure is readable in that scale, has markers around all of the axes. It is critical that all data include uncertainty.

Table – Data values acquired through our great experiment.

|  |  |
| --- | --- |
| Pressure (bar) | Signal (mV) |
| $$1.1\pm 0.1$$ | $$12.7\pm 1.2$$ |
| $$2.3\pm 0.1$$ | $$117.9\pm 10.2$$ |
| $$3.2\pm 0.3$$ | $$246.3\pm 3.1$$ |
| $$4.5\pm 0.5$$ | $$167.4\pm 14.2$$ |
| $$5.8\pm 0.3$$ | $$353.4\pm 12.2$$ |
| $$6.1\pm 0.7$$ | $$391.3\pm 22.1$$ |
| $$8.1\pm 0.3$$ | $$542.0\pm 74.2$$ |

When describing your data, it is critical that you include a description of sources of uncertainty and how you arrived at the uncertainty values you are listing.

You may be comparing your data with theoretical values. In this case, both should appear on the same graph and a description of what you have done. Often we are relating a theoretical expression or equation (see Eq. 1)[[3]](#endnote-3), to our experimental results.

$ρ\left(\frac{∂\vec{v}}{∂t}+\vec{v}⋅∇\vec{v}\right)=-∇p+∇⋅T+\vec{f}$ 1

If you are doing an analysis of the data, you need to describe that analysis. You need to make certain that you do uncertainty propagation through the analysis.

You need to come up with final values and their uncertainty.

You need to relate these results to your initial question and how this answers that question and fits within your framework.

If you are using an analysis technique developed in another paper, there should be references.

The experiment section is usually the first section to be written because it is the most straight forward to write. One usually has the best grasp of what the apparatus was and what it did.

The most difficult to write is often the introduction. However, the results section is the most important section for the author. Writing is a critical activity because it is during the writing process that you figure out the meaning of what you did. You might start with way too many equations that describe each and every step of what you did. Then you start to pare it down to a more manageable size removing the extraneous. But this is critical for you to figure out what you did. This is the learning experience for the author. Forget about writing for an external audience. Write so that **you** understand the topic clearly. Be certain to concentrate on key issues to YOU!

The secondary audience is that of your peers. Make certain that you write so that your peers understand what you have done. Worry least about your professor and what they know. You are not writing explicitly for them but for yourself and a peer reviewer’s and your peers. Always keep that in mind. If there is something which you found difficult to understand, then explain it for others.

# Conclusion

At this point you have come up with an answer to your question. You reiterate the value of the findings and how they fit within the framework. You might also describe improvements and future measurements.

I hope you have made good use of your opportunity to learn about your own investigation. If you wrote for yourself and not for anyone else, then you should feel proud of what you have accomplished. If and when you receive peer comments on your work, then accept the criticism and try and improve your paper for resubmission. It may be possible that you will not agree with the reviewer. In this case, make a reasoned case to the editor and perhaps to the reviewer and explain why you believe the reviewer is wrong. Do not get upset.

# References

1. A. Einstein, B. Podolsky, and N. Rosen. “Can Quantum Mechanical Description of Physical Reality be Considered Complete?” Physical Review, **47**, 777-780 (1935). [↑](#endnote-ref-1)
2. Author1, Author2, and Author3. “This is the title,” This is the Journal Name (not abbreviated), **Journal Volume**, inclusive pages (YEAR). [↑](#endnote-ref-2)
3. This is the Navier-Stokes equation. Just looking at the equation, what can you say about $T$? [↑](#endnote-ref-3)