

Writing Suggestions for Physics 222

While Researching Your Topic

- Remember that the topic you cover should go well beyond what is covered in the textbook.
- Focus the paper around a single thesis statement or question. Focus. FOCUS!
- Make sure you are using current sources.
- Use both review-type articles and cutting edge research reports. If you have a long list of cutting-edge hard to understand references and one book or review article, I'll know that you pretty much followed one source, and threw the other references in for looks.
- The web is a good resource for getting ideas, but... you can't believe something just because it's on the web. Avoid citing more than one or two web pages. Use peer-reviewed journal articles and books as your primary sources.
- Good sources of review articles include the journals *Physics Today*, *Reviews of Modern Physics*, *Science*, and *Nature* as well as books.
- Good sources of cutting edge research reports include *Physical Review Letters*, *Physical Review A,B,C*, and *D*, *Science*, and *Nature*.
- Use and cite *at least* 8 unique sources.

While Writing the Paper

- Read your paper out loud --- you will find many mistakes and get a better feel for how the paper flows this way.
- Make a detailed outline and follow it --- one of the biggest problems I see on papers for this course is poor organization and lack of a natural flow!
- Don't repeat the same information over and over again. This can be avoided by good organization. I repeat, Don't repeat the same information over and over again!
- Don't include every fact that you've discovered. You will learn more while you research the paper than will fit within the focus of your paper. Have the courage to focus your paper and leave out irrelevant discussions.
- Don't repeat the same information over again. See how annoying it gets?
- Try to write a good, solid paper that conveys information in an easy to read manner. Humor is nice, but don't try to be too clever or funny. Quotes from *Seinfeld* or *George Washington* should usually be avoided in this type of paper.
- Don't repeat the same information over and over again. Yes, I'm being funny, but I'm also making a point. It is a waste of the reader's time to read about the same content more than once. If they want to read the paper again, that is up to them. Organize your ideas well so that your paper can flow from one topic to the next without going back to an idea a second time.

Abstract

- Does your abstract appear on the title page under the title, authors, and date?
- In your abstract do you clearly identify all of the major topics that will be discussed in your paper in the order they appear in the paper?
- It is best to write the abstract after the paper is in its final form.
- An abstract is not an introduction, a soundbite, or a commercial for your paper. An abstract should tell us what we will read about if we read the paper.

Introduction

- In the first paragraph or two do you define the subject matter that will be discussed in the paper? Is there a thesis statement early in the introduction?
- In your introduction do you mention what your paper does not discuss? Will your discussion of your topic include relativistic effects, quantum effects, etc.?
- Are you comfortable with the scope of your paper? Is your paper broad enough to be significant? Is it narrow enough to be adequately covered within the time and space allotted?
- If you include a section of background information in your paper, do you explain clearly how it relates to the main topic you are exploring?
- The introduction is usually best written after the main body of the paper is complete.
- Do you lay out the organization of the paper in the introduction so the reader can follow the flow of what you are going to say?
- The introduction is not a commercial. For example, something like... "Is the universe going to expand forever? Stay tuned and we'll answer this exciting question and thrill you with..." is probably not appropriate. "Our story begins with..." is also a bad way to start a scientific paper. I want this paper to be training for real research papers which you will some day be submitting to respectable journals.

Main Body

- Is your choice of words consistent with scientific writing?
- Naturally you should eliminate unnecessary words such as "basically", "obviously", "naturally", "of course", etc., obviously. They are, of course, basically not needed, and they obviously make your sentences bloated.
- Does the tone of your paper portray you, the authors, as physicists, as opposed to outsiders to the physics community? Consider the following sentence: "Scientists have shown that black holes exist." Aren't you a scientist? This sentence makes it sound like you don't know what you are talking about. A better sentence would be, "It has been shown that black holes exist." And, by the way, a statement like that should include a citation to a source which shows that black holes exist.
- Formal scientific writing does not mean you have to make your papers dull and dry. It *does* require you to write very clearly, making your paper flow from one idea to the next.

- If you are not sure exactly what an equation or a concept means, it is not honest to include it. I'll know when you are bluffing!
- Avoid creating the illusion that you know everything.
- Have you eliminated footnotes and parenthetical statements? There are cases where footnotes and parenthetical statements are appropriate; however, if what you say is important enough to include in the paper in the first place it probably should be included in the main body.
- Do your transitions lead the reader from one concept to the next without confusion? A good way to test this is to ask a person who is not in the class to read your paper. If he or she has a hard time understanding what you mean, then you need to revise.
- When you let someone read your paper, let them use this guide so they can respond more effectively to your paper.
- Do your figures have captions?

Conclusion

- Does your conclusion restate the main points you discussed in the main body of the paper?
- Be sure not to introduce new information in your conclusion.
- Does your conclusion contain personal reflections on what you or your group gained from this experience, what you found exciting, puzzling, etc.? Did this experience increase your desire to learn more?
- Did writing this paper enhance your Physics 222 experience? You may want to share why or why not, or any suggestions you have for an improved assignment.

Documentation

- Have you given credit where credit is due, including paraphrases as well as direct quotes?
- Did you give credit in figure captions for "borrowed" figures by including a reference. For example, at the end of a figure caption you should write something like... Figure reproduced from [Spe 97].
- Avoid footnotes. All citations should be endnotes.
- Follow the OSA Style Guide in your references.
- Are all of the citations complete, including the author, the title, the journal, the volume, the page that the article starts on, and the year it was published?
- Is each referenced work listed only once in the Bibliography, regardless of how many times it is cited?
- I don't want to see any "ibids!"

Miscellaneous

- Did you insert page numbers?
- Does your paper use only the present tense except when treating historical events?

- Did you treat mathematical expressions as part of a sentence with appropriate punctuation?
- Where appropriate, integrate good pictures and graphs in your paper.
- Do your tables and figures have a paragraph in the text that clearly explain what they mean?
- Do your tables and graphs appear on the same page where they are discussed whenever possible?
- Does your paper have the appropriate length?

Before Turning in Your Paper

- Did you carefully proofread your final copy for grammar and punctuation errors?
- Did you spell-check your paper?
- Did a fellow 222 classmate you trust review your paper before you turned in the final copy?
- Did you check the deadline and the last minute availability of the printer or photocopier?
- Did you read the paper aloud?

Some common problems I've seen in past papers

1. Problem: The references in some figure captions did not make it clear if the reference was giving credit to another work from which the *figure* was “borrowed” or if it was giving credit to another work from which the *information* in the figure caption was taken.

Solution: If possible, don't put information that requires a reference in the figure caption. And if you “borrow” a figure, don't just put a reference at the end of the caption.

BAD EXAMPLE: “Theoretical and experimental blackbody curves. The solid line represents experimental measurements, and the dotted and dashed lines represent the curves predicted by the Rayleigh-Jeans equation and the Planck equation [4].”

Instead, say something like... “figure reproduced from [4]” where [4] is the reference from which you lifted the figure.

GOOD EXAMPLE: “Theoretical and experimental blackbody curves. The solid line represents experimental measurements, and the dotted and dashed lines represent the curves predicted by the Rayleigh-Jeans equation and the Planck equation. Figure reproduced from [4].”

Do you see the difference?

2. Problem: Topics were discussed in one part of the paper, and then discussed again in another part of the paper.

Solution: Better organization, more careful editing.

3. Problem: Corny humor

Solution: Include humor if you like, but make sure it adds to rather than detracts from the purpose of the paper. Also, keep the funny comments short. While your reader may be willing to suffer through a short bad joke, they will resent having to spend several minutes of their valuable time reading something that they might not find funny. When in doubt, take a serious rather than a humorous tone.

4. Problem: The paper jumps from one topic to another without a smooth transition.

Solution: If you have a bad transition you can try three things. First, you can try to write a better transition. Second, you can try to rearrange the order of topics so that it flows more naturally. Third, you might reconsider whether the particular topic really needs to be in the paper. Many papers I've graded had sections which weren't very closely related to the rest of the paper. I realize that you put a lot of work into researching your topic, but you should not put everything that you learned into the paper --- only what is relevant. This is one of the most important lessons to learn as a writer!

5. Problem: It was obvious that the author didn't really understand what they were discussing.

Solution: If the topic you are struggling with isn't central to the paper, you might just consider removing it from the paper. Otherwise, you'd better get a sound understanding before you write about it. I'll know if you're bluffing. Trying to talk about something that you don't understand will not only prove to your reader that you don't understand, but will make them suspect everything else that you write.

6. Problem: Very specific claims were made without a reference.

Solution: If you read in a paper that bzikier birds can grow to be over 90 feet tall, you should reference that paper when you state that bzikier birds can be over 90 feet tall.

7. Problem: Very strange (and incorrect) ideas were presented. Web url's, news related publications, or popular science publications were cited as the source.

Solution #1: Don't rely on web pages for your information. There is a lot of good information on the web, but there is also a lot of bunk and it can be hard to tell the

difference unless you are an expert. Web pages may be a good place to start your research, but very quickly you should move to books and reviewed journals. In journals such as “Reviews of Modern Physics,” “Science,” and “Physical Review Letters,” every paper is read and approved by several experts in the field before they are accepted for publication.

Solution #2: Don’t believe everything in print either. Some sources that have good information but which often get way off the mark include Discover, Popular Science and Slashdot. You can find popularized articles which are almost always reliable in Physics Today, Scientific American, Science News, and at <http://focus.aps.org/> and <http://www.aps.org/apsnews/>. Articles found in these sources often provide a good start for your research, but usually don’t go deep enough to be the “end” of your research.

8. Problem: Sentences often repeated the information in the previous sentence. For example, “One may wonder why fish don’t ride bicycles. The reason that fish don’t ride bicycles is...”

Solution: First of all, starting a sentence with “One may wonder...” is probably a bad idea in the first place --- it’s big and fluffy and uses up valuable space in your paper. Also, it is important to carefully edit your paper so that you say as much as possible as clearly as possible in as few words as possible. Don’t make your reader commit the next ten years to reading your paper --- give them the most understanding you can for the least possible effort on their part.

9. Problem: Some papers discussed “possible experiments” which I knew had already been done.

Solution: Make sure that you have read the latest articles on your topic.

10. Problem: Irrelevant facts were dropped into the middle of paragraphs.

Solution: Make sure that your paragraphs have a central focus, and that they stick to the focus.

11. Problem: Some papers made unreasonable predictions as to the future of a particular field.

Solution: Since you are new to the field, you should be careful about making predictions (since the experts in the field will probably make better ones). If you are paraphrasing a prediction made by an expert in the field, make sure that this is clear and include a reference. If you have a good reason to make your prediction, explain your reason. I’m not going to just accept it on the authority of someone with only weeks of experience in the field (I hope that didn’t sound rude).

12. Problem: Overuse of quotes

Solution: Make sure that you have a reason to use a quote. One reason could be that someone else said it way better than you ever could. If they said it just a little better than you could, try to paraphrase rather than quote. Another reason may be to add authority. I might have a hard time believing that fish ride bicycles (note the brevity of my humor), but I might be convinced by a quotation from a well regarded expert. Also, unless you have a really good reason, don't include quotes which are longer than a sentence or two.