GRAND CHALLENGE SOLUTION GUIDELINES

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PHYS 1308

Overview

The Grand Challenge physics problem is an open-ended, non-textbook question that you are given at the beginning of the course. You have almost the entire semester to work on it in small leaps and bounds. You must use physics principles to motivate investigation of possible answers, perform calculations to assess those answers, and describe the results of your calculations. You will put the solutions in a clear, well-written document, and hand this in at the end of the semester. You will then be asked to meet with the instructor outside of class to discuss your solution. You will be graded on:

- the development of your ideas throughout the semester - this cannot be a last-minute exercise, as the quality of your work will be shoddy and thin as a result;
- the creativity, originality, or novelty of the ideas that lead to your final answers;
- your ability to investigate the ideas through physics calculations and supporting material;
- and the reliability and accuracy of your calculations.

Below are detailed instructions on the process and the written work.

The Process

- You will be assembled into a random team of about 5 people on the class day following the last day to add/drop classes withour a grade record (see Syllabus or SMU Academic Calendar).
- **Week 2**: You will meet with the members of your team and decide on a time and day of the week where you can meet once per week to discuss the Grand Challenge problem. The agreed-upon time and day will be emailed to the instructor by the team. This is to confirm that a team meeting date has been set by every team.

  Designate one person in the group to be the "Lead Editor" for the group. This is the person who will coordinate the incremental writing of the document. **[PRO TIP: Coordinate the writing of the document using a tool like Dropbox, which lets you share documents for editing with other people; or, take advantage of Google Docs or a similar cloud-based system to share a document amongst a group of people for editing].**

  Get to know your teammates. What are their interests? What expertise do they have? Is one person very good at cooking up crazy ideas, while another person is very good at calculus? Find each

other's strengths and learn to work together to create something awesome.

Oh, and choose a name for your team. Be creative, but also polite and respectful, with your choice. Make sure everyone in the team agrees on it.

- **Weeks 3-13**: Meet with your teammates once per week outside of class. Discuss how that week's material, or any previous material, could be used to arrive at an interesting answer to the question. You should begin your write-up immediately, incrementally adding to it throughout the semester (e.g. in Week 1, start by writing the title page with the information requested below). The Lead Editor should coordinate edits, or can be the sole writer; however, all members of the group are expected to contribute to the solution and understand all parts of it.

  Once per month, you will meet as a team with the instructor to discuss progress, problems, etc. Use this time to present and defend your ideas and get feedback from the instructor.

- **Week 14**: Hand in the final write-up of the solution. The final deadline for the write-up is no later than 5pm on the last day of classes, but do not wait until the last minute to hand it in. It should be emailed in electronic form (not printed!) to the instructor. It is not received unless a confirmation mail is sent back by the instructor. I strongly recommend you email a copy of the assignment to yourself as a backup.

- **FINAL EXAM PERIOD**: During the final exam, your team will receive questions specific to your write-up. The answers you give to these questions will be used to assess your understanding of the work you and your team have done.

Solution Write-up

An example write-up will be made available to help you understand what is expected. Below are the fundamental guidelines for the document.

- Expected length: At least 10 pages, and no more than 15 pages, including written and descriptive text and calculations.
- Format: Electronic (PDF is preferred for the final document you submit).
  - Use a word processor like Microsoft Word, Google Docs, Apple's iWork Pages, or LibreOffice Writer to generate the text content of the write-up. All of these can export/print to PDF.
  - Use an equation editor to write-up your step-by-step mathematical solutions; or write them neatly by hand (make sure the person tasked with this writes very neatly!), scan them, and add them into the document digitally as images.
  - You can either place the equations in the text directly, or place them all at the end of the document and refer to them in the text.
- Document Guidelines
  - 1-inch margins on all sides
  - 12-point font, Times New Roman or equivalent Serif Font

- Double-spaced line separation
- Title Page (does not count toward the length) - should at least contain:
  * Title: This should be something simple and declarative - poetry not required. Look at scientific papers for inspiration on this.
  * Authors: All members of your group should be listed alphabetically by last name, along with their major (declared or undeclared) in brackets next to their name.
  * Team Name: Put that polite and respectful (but creative!) team name on your title page.
  * Course information: Number and name of course, semester in which it was taught.
- Collaboration Page (does not count toward the page length)
  * List the names of each teammate again, in alphabetical order by last name, each on a different line. Next to each name, state explicitly their contributions to the document. If somebody generated a specific idea, put it next to their name. If someone was responsible for a particular calculation, write it next to their name. If someone else had the responsibility to check all the calculations, put it next to their name. Be explicit about who did what for the document.
- Content of the Document: See below for details - this is what determines whether or not you meet the page length requirements.
- Bibliography (does not count toward the length)
- Graphics and tables can be included if they are necessary to demonstrate or augment the solution, but they do not help your page length.
- No more than 25% of the document length can be block quotes. Exceeding this will count as plagiarism (see below).

- Content of the Document
  - The document must begin with a short introduction that (a) discusses the problem to be addressed and (b) very briefly and broadly discusses what answers you will motivate in the document. This should take no more than 1 page.
  - The bulk of the document will be your actual text and mathematical solutions. You will (a) motivate the reasons for each idea you use to answer the question, (b) describe any input data (physical constants or other such numerical parameters) and assumptions that you make when setting up the solution, (c) detail your solution using step-by-step mathematics (these should follow the guidelines of a good, clear, written solution to a homework problem), and (d) draw any conclusions or further predictions based on your calculations.
  - The last page of the document should be your conclusion. Reiterate the problem that you were trying to solve. Briefly remind the reader of your ideas, what principles you applied, and the results of the calculations. Comment on any possible future directions that your work might suggest.

- References/Bibliography
  - If you use an external inputs to motivate your ideas - for instance, if you got your idea from an external source, or numbers or other data for the calculation from an external source - then cite it. Wherever you first mention the external data or idea in your text, input a reference (e.g. a

pointer, in square brackets, to the appropriate bibliographic entry, such as [1] to mean "Reference 1 in the bibliography," or [AUTHOR] if you choose to list your bibliographic entries by author names).

- In the bibliography itself, you should then have a corresponding entry that follows some standard guidelines (e.g. MLA, or Chicago Manual of Style) for bibliographic entries: authors, title, journal or other publication, volume, issue, pages, date of publication, web link, etc.

Assessment - 80% team, 20% individual

Your final document will be assessed on the following categories:

1. Adherence: your ability to follow and implement the guidelines above. Medical and scientific journals, as well as federal funding agencies, routinely reject papers and proposals based solely on non-compliance with guidelines. This course will have no different standards than those of agencies with which you will, no doubt, one day interact in some capacity.

2. Writing: the quality of your writing should reflect the rules of English grammar, spelling, and follow the guidelines of well-structured writing. Scientific writing uses short, declarative sentences, absent flowery prose. The key to good scientific writing is to communicate ideas in a clear way. This is so that the reader can reproduce or critique the results. This is the same standard to which authors in the best journals are held; it will be applied here.

3. Creativity: even if your inspiration comes from an external source (cite the source!), what matters is what you do next. All scientists build on the ideas of those that came before them. You should cite your inspiration and then do something awesome with it. That is what matters. Your ability to apply basic ideas to generate an interesting possible outcome or conclusion will be assessed. Science is a creative process. Your ability to be creative is key to becoming a good scientist, doctor, lawyer, engineer, businessperson, politician, teacher, or any other such career path. Use this challenge to develop your creativity. Synthesizing information from PHYS 1307 and PHYS 1308 is a key part of creativity; your ability to combine principles to generate new information will be assessed.

4. Accuracy: your ability to apply the correct principles from PHYS 1308 (and PHYS 1307), then carefully and accurately generate numerical predictions from them, will be assessed. You should triple-check your calculations (have multiple people in your team independently check a single calculation, then compare notes and determine whether or not the calculation is correct) and then check them one more time. Use your teammates wisely! You have a lot of brainpower in your team - don't squander it. Remember, it's not about a single person having the best idea; it's about the team succeeding because everybody is contributing their core strength to the whole.

The above will be graded across the entire team as a single effort, and the members of the team get the grade that the team gets. This amounts to 80% of your Grand Challenge Physics Problem grade.

The remaining 20% of your Grand Challenge Physics Problem grade will be determined by your answers to questions on the final exam specific to your team's write-up. This assesses your individual understanding of material. It may cover material for which you are not listed as responsible, but of which you should have a good working knowledge. Anything discussed in the team write-up is fair game.

Plagiarism

DO NOT PLAGIARIZE. Plagiarism results in an automatic F on the assignment for the whole team. What do I mean by "plagiarism"?

- Plagiarism is taking another person's work and representing it as your own.
  - If your ideas for solutions come from an external source and you do not cite it, that is plagiarism.
  - If you knowingly take ideas from other teams and represent them as your own without citing the other team's input, that is plagiarism. If you get an idea from another team (even if you cite it) and just do the same calculation as them, that is plagiarism. This latter approach lacks any and all creativity, something upon which you will be graded.
  - If you copy written text from an external source, such as an article, book, speech, or other work, and use that text in your write-up to save time without (a) putting it in quotations as a "block quote" or (b) citing the original source, that is plagiarism.
  - If you use a previous class's Grand Challenge write-up as the basis of your own, even if you cite it, that is plagiarism. Do your own work.

If you are unsure if something you are doing is plagiarism, ask the instructor before you do it. Plagiarism only occurs when you've already handed in the final product and then it is detected by the instructor. If you discuss it PRIOR to handing in the assignment, no plagiarism has occurred and we can find a solution ahead of time with no penalty.

The Grand Challenge solutions will be run through software that is designed to search a massive - and I mean MASSIVE - database of work, including essays and papers from students at hundreds of other institutions. If a significant match is detected that cannot be explained by block quoting or quoting of any kind, then a plagiarism discussion will occur. Let's not get to that stage. Write your own material, do your own calculations, and discuss sources of ideas or other material with the instructor.