

Computing Distances and Linear Sizes or Separations Using Angles

INSTRUCTIONS FOR WRITING LAB REPORTS

Format Guidelines

Before getting into what a formal report should be, the format and writing style should be similar to this model, including obvious section titles. The report should be typed, preferably on a computer so that you can make lengthy revisions quickly, and there should be a meaningful title, section headings, and a double-spaced (or 1.5-spaced) body. If you include tables, drawings, or figures, they should be at the end of the report on separate pages or embedded in or near the referring text (i.e. tables/figures should not be the only thing on a page in the middle of the report). There is no set length requirement for the lab report, but you should have discussed everything necessary. It is incredibly rare to see a good lab report shorter than 3 full pages. Typical good reports are 5+ pages.

Introduction

The purpose of this document is to provide instructions for students on how to write formal lab reports for their Astronomy 12 class. This is an important task because most students have never been taught how to convey technical information properly in a report format. A lab report is a way of presenting a subject, reporting on the observations or the results of experimentation/research, and a discussion of the results and the meaning of what the author has done. A technical report is not designed to be read from beginning to end. Different people will read different sections, depending upon their needs. Technical reports should include an Introduction, Observation (or Experiment and/or Research), Discussion, and Conclusion sections. Our lab reports will include Introduction, Observation, and Results sections (unless you see the need to do otherwise).

When an expert reads a technical report, they usually turn right to the observation or experiment section to see **exactly how** the work was done. A manager or another researcher that is utilizing your work in a larger context would want to skip that part (since the details are not useful to them), and would read the results and interpretation section to **understand the meaning or significance** of the work. A potential investor, a novice, or another researcher that is not familiar with this area of work would want to read the introduction section to learn **what** was done, what is in the report, **and why the work is useful**.

Presenting technical information in a manner that allows the user to quickly access only the desired information is becoming increasingly important as the information revolution progresses. A technical report is equivalent to a web page where you only click on the hyperlinks that will lead you to the information that you desire. Hopefully this instruction sheet will serve as an example of how technical reports should be written. Notice that this section provides a description of the entire document, up front, followed by a useful description of terms or ideas that the novice reader will find useful in the rest of the document. It also includes a motivation for why the work was done as well as any needed background information for a novice reader. The introduction

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section finishes with a motivation for the entire report. Usually the introduction is the hardest part of the lab to write. Many experts leave this section for the end, since they are more familiar with the details of the experiment and have lost their novice perspective. A satisfactory introduction will contain the following 4 things: purpose of lab, motivation for the lab, background information about the material, and a description of the overall activity.

Notice the manner in which this report is written. It is not written with a conversational tone, but rather as a formal document describing what is done, with few, if any, references to “I” or “we” – though that is allowed. There are (hopefully) few unnecessary tidbits of information. Lab reports are written to be concise and very informative. Reading reports should take much more time than reading prose because every single sentence is important in a lab report. In the scientific community, brevity is key because nobody wants to read fluff, and the authors are charged to publish each word in the report. You should not ask rhetorical questions nor should you assume the reader knows “what you mean.” Make your points perfectly clear. Once you have fine-tuned these skills, you should have little difficulty writing for your employer(s) in the real world. You will find that during the process of writing this report, you will have gathered your thoughts and synthesized the information. Hopefully, after this report is completed, you will have learned what you did in the experiment(s), why you did it, and what the key concepts were behind the exercise(s). You may find it helpful to start with an outline before you start writing.

The Introduction section above described what the report is, what it contains, and helps set the stage for the novice. A friend or family member (who has not taken this course) should know **exactly** what you have done in the lab after reading **only** the Introduction section. Verify this and do not let them ask you any questions. If they need to ask questions, you need to revise your report. Do not write your report assuming that your professor (or a classmate) will read it – they are not the intended audience. Always keep your target audience in mind. (Notice how long this introduction section is compared to the rest of the report.)

Observations

In this section, you should present the experiment, including the **precise** methods, the measurements, and observations. Any sketches, data, or equipment should be used here, if necessary. Do not redraw your sketches. That is equivalent to making up new data. Any information you need to supplement your original data should also be included (e.g. descriptions of drawings, potentially including features you observed but could not accurately draw). When appropriate, you should include tables of information, as opposed to lists of numbers written in paragraphs. The tables’ captions should include what you saw, when you saw it, and the status of the equipment used (e.g. telescope, magnification, etc.)

When describing the method of the experiment, it is critical to accurately describe how you performed the experiment. This part of the report should essentially be a “cookbook” style, allowing a novice reader to

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recreate your entire experiment based solely on the information presented in this section. Details are important. For observational labs, this would include a description of the size and type of telescope, where you were located, what the weather was like, who your partners were and what jobs they performed, how you used the telescope, what you observed, including any description not obvious from pictures you include, etc. An example: “After doing a quick polar alignment (described above), observations of Jupiter were performed on November 29 and December 6, 2000 from 8:00pm-10:10 p.m. ECC’s 8-inch Schmidt-Cassegrain telescope (#8), with a focal length of 2000mm, was used on both occasions. Sketches of the planet were drawn while viewing through the high power (17 mm) eyepiece. Figures 1 and 2 show the sketches that were made at the telescope on the indicated nights.” Notice that the only thing appearing in this section is how the data were obtained and what they are. No discussion of what they mean appears in this section. (No discussion of what is in the drawings is seen here. Just the drawings.)

For an indoor lab, this section should include a detailed description of how you performed the tasks. You should discuss what equipment was used, what aids you had, all of the original data (i.e. no averages), etc. Results, interpretations, and other things that require thought should appear in the next section, not this one.

Discussion and Results

In large reports, a discussion of your data and the conclusions are separate sections. For our purposes, you can include them both in a single section. We will call this combined section the Results section. In this section, you should discuss what you determined from your data, what it all means, and what you learned (or did not learn, should that be the case). To help you start, you should refer back to the lab instructions. Many of the important concepts are in there. Some will be written explicitly, while others will require you to do some independent thinking.

In the write-up, you will find many questions. Those are a good starting point for the results section. However, this section should be stand-alone and should be written in complete sentences. You should not simply answer the questions in the write-up, but rather, refer to the data in the observations section, and discuss how your data allow you to find the answers. Hopefully, you will be able to supplement the questions asked in the write-up with questions of your own, and answer some of them. It is ok to ask questions even if you cannot answer them. Part of science is asking questions for future observers to answer.

In addition to those questions, you should discuss several other things in this section. You should talk about any problems you encountered and how you solved them. If you had difficulty with certain parts of the lab (either physically, or conceptually) include details of the problem(s). Any questions you had that were not answered by the activity should appear here as well. You should also discuss any errors that could (or did) occur and how they could be reduced. (If different members of the group had different observations or different numbers for the same measurement, discuss why that is the case and why this is not a fundamental flaw in

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nature.) Simply saying “There’s always human error” is a waste of ink. What kinds of human error are you referring to? If you may have counted incorrectly, how close did you come, and how could you improve your counting techniques? Any problems with the equipment should be mentioned, but do not blame all of your problems on the equipment!

Special Astronomy 12 section for the lab report

On the lab handouts, there may be some questions you were asked to answer that do not fit neatly into other areas of your report. They should be included in this final, supplemental section. Also, you should include a summary of your personal experience of this lab. (This does not usually appear in a formal lab report.) Include anything that was not already mentioned, such as what you liked and did not like about the activity, how much time you spent writing the report and figuring out the information, any revisions you’d suggest to the professor or future students, etc. This is your chance to compliment the professor or express your concerns and complaints. Be candid, but constructive. Complaints are only useful if something can be reasonably done to prevent similar future discomforts.

How your grade will be determined

Penalties will be assessed for not typing the report as well as not:

Introduction:

- 1) Giving some background (including some history) information about the lab and the tasks.
- 2) explaining the usefulness of the lab and why you are doing it
- 3) explaining what was done (in an overall way)
- 4) being clear in your writing (have a friend check this)

Observations:

- 5) providing a detailed description of the equipment and how it was used. This should read like a cookbook.
- 6) presenting data in an appropriate format (usually a table with numbers, not text)

Results:

- 7) concluding what can be deduced from the data and related calculations
- 8) answering questions from the lab handout (or those that are appropriate for this report) and clearly pointing out the supporting data
- 9) estimating errors (both types of errors and a numerical estimate on the size of these errors) and commenting on how they can be reduced

Special Astro 12 section

- 10) answering other questions in the lab handout
- 11) providing personal comments (as described above)