

# Guidelines for Writing a Formal Laboratory Report

Scientific writing shares with all expository writing the goal of conveying information as clearly as possible to the reader. Chemists have developed a set of conventions to make the results of their work easily accessible to their peers; by following the same conventions for your lab reports, you allow other chemists to analyze your work. The following outlines briefly how to apply these conventions to your formal laboratory reports in chemistry courses at Smith. Your lab instructor may provide examples and/or additional instructions specific to your current course. Other valuable sources include: chemistry journals (e.g. *Journal of the American Chemical Society*), the *ACS Style Guide* (available in Young Science Library or from your instructor) and the Jacobson Center.

## Structure of lab reports

Reports will be divided generally into the following sections, in order of appearance:

1. Abstract (optional): A short (~100 words) description of what was done and the major result(s) and conclusion(s).
2. Introduction: This section tells the reader why you did the experiment. It includes some or all of the following: background information, an explanation of the hypothesis you set out to test and the results of previous, closely-related experiments. When the reader finishes reading the introduction, she should know what to expect in the report.
3. Experimental: This section (called "Materials and Methods" in biology) describes what you did in enough detail that someone else with your level of experience could repeat the experiment. Your description must therefore be quantitative (for instance, what temperature did you heat the mixture to and for how long?) as well as specific (for instance, what are the make and model of the spectrometer you used for analysis?). Note that this section sometimes comes at the end of the lab report (particularly in organic chemistry); your instructor will tell you if that is the case.
4. Results: In this section you present the data from your experiment. (Note that some simple data, such as the yield from a synthetic step, may be presented in the Experimental section; check with your instructor for your specific lab.) You may use tables and/or figures to present the results, but you should describe any relevant features of the results completely within the text, referring the reader to the appropriate table or figure as necessary. Keep in mind that tables are useful when the reader wants to know the exact numerical value of a result, while graphs are useful for showing trends and for deriving values from a statistical fit of data. Both tables and figures should be numbered sequentially, and each should have a descriptive title. **Tables** may be presented in any format that clearly delineates rows and columns from each other. Headings should indicate the units associated with any value. **Figures** may include any graphic information such as schematics of experimental apparatus and drawings of large molecules; in your lab reports figures will most often be graphs. The same instructions apply to graphs as to the rest of your report: present the material in the simplest and clearest manner possible. Your instructor may give you further hints.

5. Discussion: This is the section where you explain to the reader the significance of the results you presented above. Your discussion will include some or all of the following: comparison of your results to literature or theoretical results, evaluation of how your data support or refute your original hypothesis, analysis of possible sources of error, relevance of your results to a larger field of study, and possibilities for further study to answer any additional questions raised by your results. In some cases authors choose to combine Results and Discussion into one section; your instructor will tell you if that format is preferred for a specific course or report.
6. Conclusions (optional): This is a brief summary of the main conclusion(s), generally used when the Discussion section is particularly long.
7. References: If you have used any bibliographic sources (including a lab handout), they should be listed here. You may consult any journal or the *ACS Style Guide* for examples of acceptable formats; your instructor will tell you if a specific format is preferred.
8. Appendix (optional): Extensive calculations used to arrive at values reported in the Results section should be included here rather than in the main text; refer the reader here by writing, "A detailed description of the calculations can be found in the Appendix."

### Universal considerations

1. Passive vs. active voice: You may have been advised in other classes to avoid the passive voice in your writing. (The previous sentence is an example of passive voice; the active version would say, "Instructors in other courses may have advised you to avoid the passive voice.") In general, use of the passive voice adds unnecessary complexity. However, scientists often use passive voice, particularly when describing experimental protocols. *This is not because scientists are bad writers!* If we did the experiment well, anyone should be able to reproduce it, and we emphasize that fact by reporting the experiment as if the identity of the experimenter were inconsequential. For example, most chemists would say, "The solution was heated at 100° C for 5 hours," rather than "I heated the solution at 100° C for 5 hours." Please follow this convention and report your actions in the passive voice.
2. Past vs. present tense: Verb tense follows the philosophy described above: we want to convey that the experiment could be done at any time with the same outcome. Therefore, while actions that took place in the past are rightly described in the past tense, results are assumed to reside in the present and are described in the present tense. For example, we write, "The solution was heated at 100° C for 5 hours," because that action was carried out at a specific past time. However, if you took an infrared spectrum of the sample you made, to describe the spectrum to the reader you would use the present tense: "The absence of peaks above 3000 cm<sup>-1</sup> confirms that no OH groups remain."
3. Never start a sentence with a numeral ("2" is a numeral; "Two" is not). When reporting a quantitative amount at the start of a sentence, use the following format: "Salicylic acid (1.00 g) was added to. . . ." It is incorrect to write "1.00 g salicylic acid was added. . . ," and it is imprecise

to write "One gram salicylic acid was added. . . ."

4. For general questions of grammar and usage an excellent reference is Strunk and White's *The Elements of Style*. This book covers many of the most common errors made in writing, scientific and otherwise. Of special note for lab reports:
  - "Data" is a plural word; the singular form (for one point) is "datum." Saying "The data shows that. . ." is like saying "The people says that. . . ."
  - "Spectrum" is a singular word; more than one spectrum is a group of "spectra."