

## Writing a Formal Report for Organic Chemistry

### Basics of Writing a Formal Report in Organic Chemistry Style:

A formal report differs from the lab notebook, not primarily in content, but in organization and style. While both the lab notebook and report contain information about what you have done, what you have seen, and conclusions you have drawn from the data, the purpose of the two documents is different.

The lab notebook is designed as a record for your use in recording and storing your scientific work. You use it as a reference if you want to repeat a procedure or experiment. You use it to store scientific data that you worked hard to collect so it won't be lost. The style of the notebook reflects the purpose: because it is meant for you, the style can be less formal. It has to be neat and organized enough to find what you are looking for, but you can use a style that best suits your needs and background.

In contrast, the formal report is primarily meant for you to convey your information and conclusions to another person so that they can understand. It is a teaching tool. The fact that people of many diverse backgrounds will be reading this report requires standardization among all lab reports—there are formalities that must be followed. That is why it is called a formal report. In a formal report, the success of communicating your ideas depends as much on style and format as the information and conclusions you include in the report.

### **The rest of this handout outlines the format of the formal report.**

1. Title The title must give enough to tell the reader what to expect but stay as succinct as possible. Your name and email should go under the title. Examples:
  - “Elimination Experiments” (too generic)
  - “Eliminations of 2-methyl-2-butanol under Acidic Conditions Lead to More Stable Product formation” (too wordy)
  - “Influence of Product Stability on Products of Elimination Reactions” (just right)
2. Abstract The abstract is a one paragraph summary of the entire article that occurs at the beginning so that the reader can get the gist of what will be discussed. Based on the abstract, a reader will choose to read or not read the article, so it is important to write this section especially well. The abstract **MUST** contain this information in as succinct a manner as possible: major experiment and techniques, major data, major conclusions, and a ChemDraw Scheme. The abstract should not contain every finding or conclusion, and should not have a detailed procedure, but you must address all these areas. It should be written in passive, past tense, and not first person. Example:

I mixed together 10 mL of sulfuric acid and 3.0 mL of 2-methyl-2-butanol and distilled a mixture of alkene products. The product was collected in a

25 mL Erlenmeyer flask. We used ice. Product stability was the main factor in which product was the major product.

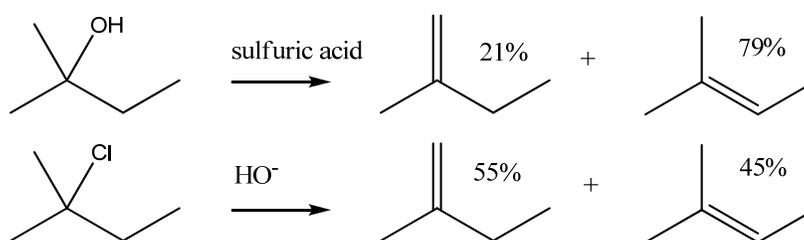
Problems:

- First person was used
- Too much experimental detail
- No reference to results or how they were obtained
- No scheme

Good points:

- Past tense, passive
- Major conclusion included

Here is a better example of an abstract:



Elimination reactions were conducted under acidic and basic conditions. The mixture of alkene products was collected by distillation and analyzed by gas chromatography. Under acidic conditions, the tri-substituted alkene was favored over the disubstituted alkene in a 79/21 ratio. Under basic conditions, the disubstituted alkene was the major product in a 55/45 ratio. Based on these data, it appears that product stability is the major factor influencing product distribution under acid conditions, while sterics play a more major role under basic conditions.

3. Introduction The introduction is included in the formal report for a few reasons. First, it gives the reader background into the scientific issues being discussed. What are some of the key terms and definitions used? How have other scientists approached the problem in the past and what have they concluded? Second, it gives the reader a perspective of why the research and findings are important to the scientific community. The introduction therefore is often highly cited with previous works.

\*\*\*This section is the hardest section for an inexperienced scientist to write because it requires some more substantial background in the field. Therefore, in this course, you will be given guidance for each paper in the type of sources to use.\*\*\*

4. Results and Discussion This is the meat of the paper. In most organic chemistry papers, the results and discussion are not separated, but woven together into a seamless discussion that makes sense to the reader. The basic pattern is to

introduce data in a table or ChemDraw figure, then refer to that data in a discussion. The best way to go about this is to come up with questions that you want to answer, then think about what figures or tables would convey the data in the most straightforward way. (You can attach copies of IR, NMR, or GC data to the end of the report with a figure number.) After doing this groundwork, you can write the results and discussion section. For this first paper, here are the questions and data you must present as a minimum. You can choose to include others as needed.

General questions for synthesis papers:

- Did I synthesize my target compound?
- What yield of the target did I get overall?
- How pure is the final product?
- Most importantly, WHAT DATA SUPPORT MY CONCLUSIONS?

Common Figures/tables

- Table of stoichiometry data
- Tables of any IR/NMR/GC/etc data (turn in actual spectra to your AI)

5. Conclusions: This is a summary of the paper, approximately one paragraph, but some people write more. It is similar to the abstract, but you might include future directions for the research.
6. Experimental Section: This is the place organic chemists give a detailed procedure of each reaction or experiment performed. First, you will write a paragraph outlining the general materials and equipment. For example, you might write, "All materials were obtained from the instructor and used without further purification. All IR spectra were obtained on a Hewlett-Packard Series 1600 IR spectrometer..."

The next paragraph will outline the next experiment with a heading in bold. If it is a synthetic experiment, the heading will be the name of the compound made. If you used another paper as a reference for your procedure, cite the paper here. Following the name, a detailed procedure is given. It is written in past, passive. It includes actual gram or volume amounts used as well as molar amounts for reagents. The procedure should be detailed enough that someone else could successfully repeat the experiment exactly as you did. After the procedure, the amount of product obtained, product observations, and % yield are given. This is followed by a summary of all the characteristic data (m.p., TLC  $R_f$  and solvent, IR data and sample technique,  $^{13}\text{C}$  and  $^1\text{H}$  NMR data, and any other characterization data.

The next experiment should start with a new heading.

7. References: Normally, the Journal of Organic Chemistry has references as a set of footnotes, but it is fine if you have them as endnotes. You should use an appropriate format, though. The format and an example are given below:

(#) Name, initials.; Name, initials. *Journal Abbrev.* **Year**, *volume #*, pages-pages.

(1) Chemist, F.A.; Student, J.D. *J. Org. Chem.* **2008**, 73, 2345-2350.

For more information, go to the Journal of Organic Chemistry, find an ARTICLE (not a NOTE) and use it as an example.