

CHEM 203 -- Writing an Effective Report in the Organic Laboratory

Introduction:

In a good introduction you provide the reader the **context** and **purpose** of your work.

Context: Take a few sentences to tell the reader where your experimental work fits into the larger scope of science. For example, suppose you are performing an experiment to synthesize the analgesic ibuprofen. A good introduction would sound like:

Chemical compounds used to alleviate pain, or analgesics, are of great importance to modern medicine.¹ A notable example of these agents is ibuprofen, a non-steroidal anti-inflammatory drug (NSAID). First prepared and marketed by the Boots Group in the UK during the 1960s,² it currently enjoys worldwide sales of over \$300 million (US\$) per year under the trade names Motrin[®] and Advil[®] as well as their generic equivalents.³

Note that it is referenced – if you make a factual claim in a scientific paper, it must either arise from your data or from a peer-reviewed source, such a book or journal article. In this course we prefer endnotes sequentially numbered (footnotes and endnotes are both freely used in the literature, however).

Websites are NOT to be referenced in your lab reports or other scientific work. This is because they are often NOT reviewed by peer scientists in the field and are fleeting in nature. Websites are constantly being reworked and rewritten and are not a permanent repository for scientific data.

However, a website like Wikipedia or Google Scholar may provide you the references from real books and journals to cite. Remember, it is not good to cite anything unless you have actually read the citation!

Purpose: Now tell the reader what you intend to add to the body of scientific knowledge. This may sound a little implausible for a CHEM 203 lab report, but you are performing an experiment in this course to prepare a compound, identify an unknown or provide data for a physical process. Basically lay out how you will conduct the experiment and what questions you hope to answer. Continuing the paragraph above:

... In this experiment, ibuprofen will be prepared from isobutylbenzene using a novel three step reaction sequence. The final product will be characterized by melting point, infrared spectroscopy (IR) and nuclear magnetic resonance spectroscopy (NMR) and an overall synthetic yield for the process will be determined.

You have now told the reader your synthesis is novel, and how you will prove that you actually obtained the target compound. This is a “promise” made to the reader and should be kept in mind as you write your discussion and conclusion statements. This will make those sections more concise and focused towards your goals!

Results and Discussion:

Before you can discuss anything you need to present data. This is best accomplished by introducing why the data was collected. What was the hypothesis in each case? Were there standards that you are comparing to or was this a novel measurement of a phenomenon?

For the sugar experiment you are trying to establish the identity of an unknown. However you have a limited subset of possible sugars (pentoses and hexoses) which are all aldoses. You should have a separate paragraph for each test and discuss what the results were. Discuss any deviations from what was expected (Bial test with a slow color change, melting point of a derivative is low, etc.).

A summary paragraph in the discussion should collect this data and formulate a possible identity for the unknown (make sure your unknown # is in the report). Here you can comment on deviations that may lead your analysis to be in error-this can help boost grades for wrong answers!

Chemical Drawings

I would like your reports to be typewritten and for you to gain experience in using the drawing software. ChemDraw® is available for free through our site license at Penn State. Follow the link:

<http://www.pserie.psu.edu/compcntr/studentlinks.htm>

Scroll down to "Software - download software (only available to Penn State students, faculty, and staff" and click on it. You will be prompted for your PSU ID and password. Here is all the software that is available free to you as a student. Go under "Technical Applications" and download ChemDraw® by following the instructions. You will have to register your e-mail with the vendor and they will send you the activation code.

Have fun with the software! It is what I use for the exams, course handouts and presentations as well as my research publications. It pastes into Word® easily and retains all of its functionality. If you double click on a ChemDraw® image in word, ChemDraw opens and you can edit within the document! There are templates for all the sugars and bio-molecules we are working with.

Conclusion:

In a good conclusion you provide the reader a synopsis of the results of your work. Although the results are thoroughly illustrated in the discussion section, you want to tie into those promises you made in the introduction.

In this example: Did you successfully make ibuprofen? Was it three steps? Did the mp, IR and NMR data match the accepted values? What key features of the data summarize this 'match'? Is this synthesis better than previous preparations?

In this experiment ibuprofen was successfully synthesized from isobutylbenzene in a three step reaction sequence in an overall synthetic yield of 56%. While this is less

efficient overall than the industrial process (synthetic yield of 72%) this synthesis avoids the use of highly toxic sodium cyanide and utilizes a recycleable reagent for the key step. The melting point of the ibuprofen obtained in this experiment was sharp (78-79 °C) and matched previous claims for this compound. Analysis of the spectral data is consistent with the accepted structure of this compound. Most notably the carbonyl band in the IR spectrum (1705 cm^{-1}) confirming the presence of non-conjugated carbonyl and the multiplet pattern observed by ^1H NMR indicative of the isobutyl group.

You have just used the last part of the introduction, with the addition of key data from the experiment (which is discussed more thoroughly in the body of the report) to formulate the conclusion statement. This brings the reader full circle to the promises made in the introduction statement.

Most conclusion statements lack references. However, for CHEM 203 reports they may be helpful especially for melting point data. If they are used (as they would in the example) they should only reiterate ones used before. No new reference should be introduced in this section.

For both the introduction and conclusion note they are not overly lengthy. Save that for the body of the report. A good length for both is about 5-8 sentences that are well developed.

For CHEM 203 make sure any unknown numbers are clearly indicated in both the introduction and conclusion sections!!!