Chem 399
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Internship Reports

I. General comments

The major part of the grade for Chem 399 is determined by the internship report. The purpose of this handout is to provide guidance in how to write the report. If, after reading this handout, you still have unanswered questions, please contact Prof. Tessier (Email address = tessier@uakron.edu, phone = (330) 972-5304).

Department of Chemistry BS chemistry degree programs are certified by the American Chemical Society (ACS), the largest professional organization in the US for chemists. To maintain certification of our programs, students are expected to write a report that *at least* meets ACS guidelines. Though ACS does not provide specific guidelines for writing a report of an internship, ACS guidelines for preparing a research report should be applied as much as possible:
http://portal.acs.org/portal/fileFetch/C/CTP_005606/pdf/CTP_005606.pdf
In addition to these general directions, more specific directions are given below.

An important

II. Style of the internship report

II.A. General Comments on Style

The style of your writing should conform to that in *The ACS Style Guide* (2nd edition, Do style or a
dy have some experience with it.

instruments and their settings, calibration methods for instruments. Provide references for standard techniques or calibration methods. If you use standard biochemistry kits such as the Quiagin Miniplasmid prep kit, mention them in the general Experimental paragraphs. Unless you make significant modifications in how the kit is used from the recommended protocol, there is no need to give the directions for kit use. Similarly, if you indicate that standard, Schlenk, synthetic techniques were used in the general paragraphs, there is no need indicate that a nitrogen or argon atmosphere was used in your description of each synthesis. However, it is important to indicate which gas was used in the general paragraphs because nitrogen reacts with some compounds. The name of companies or people who did some experiments or provided data should be included.

It is important that you be honest in writing the Experimental section. For example, consider the following two ways of describing that a precipitate forms in a reaction: “KI precipitated from the reaction” or “a colorless precipitate, presumably KI, formed”. Use the former if you did (at least) qualitative tests to assure that KI actually formed. If you just assumed KI formed because it is the expected product, then the latter phrasing is more honest. Another example occurs when solutions are exposed to vacuum in order to remove the solvent. You could say that “the solvent was removed under vacuum” but do you really know that solvent was the only component removed or that is was removed completely? Unless you actually check, it is more honest to say that “the volatile components were removed under vacuum”. In this case, it is important to specify in the introductory paragraphs of the Experimental the type of vacuum and, if possible, provide a measurement of the vacuum achieved. Fewer volatile components can be removed with an aspirator than with a vacuum pump or a vacuum-pump combined with a diffusion-pump. Such details may be important to someone trying to reproduce your work.

Results and Discussion section(s):

As indicated above, these sections deal with the explanations of your work

books from trusted publishing houses. Almost all material in our library and OhioLINK (http://www.ohiolink.edu/) is so. The manuals to instruments and software can also be used as references. Limit the number of references to web sites and personal communications because the material they contain is usually not checked or reviewed by anyone. If you must use web sites, then select sites that belong to reputable organizations or companies and include the date that you accessed them.

Appendix or Appendices

An appendix (singular) or several appendices (plural) can be added to the report. *One appendix is required* in all reports and other appedices are optional.

NMR", "the proton NMR" or “by IR”. In formal writing, use "proton NMR *spectroscopy*" or "the proton NMR *spectrum*" or “by IR *spectroscopy*” (not in

usually not captioned and captioning is optional for schemes. A scheme differs from a chemical equation in that it can contain *two or more* equations or a very complex equation. Schemes also can be used to show a set of related equations, for example a mechanism, or a set of chemical structures, as in Scheme 1 and 2 above. A chemical or mathematical equation can interrupt a paragraph whereas figures, schemes and tables are placed after the end of the paragraph or are wrapped by the text. Make a clear separation between a figure, table or scheme, with its caption, and the rest of the report. An extra line or a box around the item usually suffices.

Frequently, tables, graphs and figures that are produced by an instrument are not properly formatted (i.e. subscripts and superscripts are not used), employ abbreviations that are non-standard, use non-standard English, fail to use Greek symbols properly, etc. If you include such material in your report, edit it if possible. Alternatively, use the caption to explain and correct the computer-generated figure. If there is no easy way to add a caption to a full-page plot or figure, you can simply use an extra page on which to write the caption. Place the page just before the item.

*It is expected that equations, figures, tables and schemes will be drawn **by you** using word processing, spreadsheet, chemical drawing or numerical equation programs*. A free chemical drawing program (Knowitall Academic Edition), which includes other useful programs, is available at: http://www.knowitall.com/academic/welcome.html. Line drawings and figures that display graphical data should employ carefully chosen font sizes, symbol sizes, and line thicknesses, and these should be consistent within a given figure. See the *ACS Style Guide* for examples of well drawn and poorly drawn figures.

Special directions for crystallographic figures:

If you wish to include a drawing of a molecule that has been characterized by X-ray crystallography, you can do so in a manner that circumvents any plagiarism or copyright issues. Files that contain structural information can be downloaded from data bases of crystallographic data. With the use of certain programs to manipulate the 3-D structure, a different view of a molecule can be generated and saved. The new view of the molecule is not copyrighted and can be used in your document without fear of committing plagiarism. An example of such a drawing is shown in Figure 1.

There are several databases of structural information. For small organic and metallo-organic molecules (including a few inorganic molecules) the major structural database is the Cambridge Crystallographic Database (CCD, http://www.ccdc.cam.ac.uk/). CCD data are available in the CIF (Crystallographic Information File) format. CIFs are available as supporting information in some online journals. If the journal does not give the CIF file, it may be available it from CCD at: http://www.ccdc.cam.ac.uk/products/csd/request/. Requests for CIFs at CCD are usually granted within 1-2 days. The CIFs at CCD are free to academia. A free version of the program Mercury £ from CCD is available at http://www.ccdc.cam.ac.uk/free_services/mercury/ to manipulate the structure and produce drawings. A similar

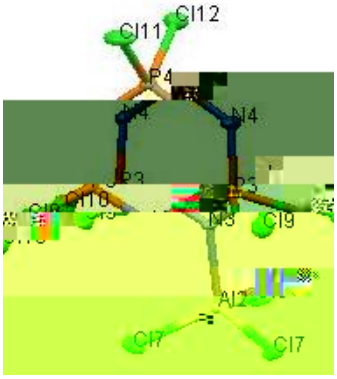

Figure 1. Example of a crystal structure plot drawn with the program Mercury £ and the CIF from: Heston, A. J.; Panzner, M.; Youngs W. J.; Tessier, C. A. *Inorg. Chem.* **2005**, *44*, 6518-6520.

(http://www.ccdc.cam.ac.uk/free_services/mercury/) and the CIF in reference 6."

- Alternative for Scenario 2: "Figure 6. Thermal ellipsoid plot of compound **7**.[6,7]" (where one reference is to the publication and the other is to the program Mercury £.)
- Scenario 3: "Table 5. The rates of ethylene hydrogenation using commercial catalysts in aqueous solution. Combined table from those in references 3 and 5."
- Scenario 4: "Figure 2. The isomers of substituted trimeric phosphazenes.[3]"

Two possible captions are given for Scenario 2. In both, the program used to draw the figure is specified because different programs have different underlying assumptions. The use a superscripted reference in the caption (Alternative for Scenario 2 and Scenario 4) is *only* acceptable if *you created the item*. Use of sentences and captions as those given in the above scenarios *will help you avoid being accused of plagiarism!* More information on plagiarism can be found later in this handout.

Style of References and Notes:

Reports will use ACS style for references, unless this mode is not used at all in your subfield. See your research advisor for advice on this point and for a style guide if non-ACS referencing is to be used. If you use a different referencing style, be consistent in it's use throughout the report.

ACS style for references

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Shriver, D. F.; Atkins, P. W.; Langford, C. H. *Inorganic Chemistry;* W. H. Freeman: New York, 1990; Chapter 7. (Alternatively, the page numbers can be given rather than a chapter number.)

- ACS Style for an article within a book with editors:

Tessier, C.; Kennedy, V. O.; Zarate, E. A. In *Inorganic and Organometallic Oligomers and Polymers*; Harrod, J. F.; Laine, R. M., Eds.; Kluwer Academic: Dordrecht, The Netherlands, 1991; pp. 13-22.

ACS Style for biochemistry

It probably is not surprising that in an interdisciplinary field such as biochemistry, there are differences and more variety in ACS referencing styles. References are usually cited using an italicized number within parentheses as shown at the end of this sentence (*6*). Place the number *before* a punctuation mark such as a comma, colon or period rather than in the middle of a sentence or phrase. An example of how to cite several references at once is shown at the end of this sentence (*1-3, 7, 11-15*). Spaces are used in the sequentially-listed, italicized, reference numbers. Most ACS journals in biochemistry use styles similar to those shown above for the citation except that the title of the article or book chapter must be included. Interestingly, the most major journal in the subfield, *Biochemistry*, uses a different method than the other ACS biochemistry journals. These two major citing methods are shown with a few examples below. Ask your research supervisor which metl

least once in the report. Be careful in overinterpreting data to make unwarranted

material in which you have no or little part in creating (especially figures, tables, and schemes). UA provides information on academic honesty in the Undergraduate Bulletin and on the web sites for the Student Judicial Affairs Office and the Office of the General Counsel.

http://www.uakron.edu/academics_majors/undergraduate_programs/ugrad.pdf (pp 7, 30, and 43)

http://www.uakron.edu/studentlife/sja/index.php

http://www.uakron.edu/ogc/staff/mallo.php

Another useful web site is: http://www.dartmouth.edu/~sources/about/what.html.

It is your responsibility to read and make sure you understand all guidelines on academic honesty given in this handout and at the above UA websites. If you do not understand, discuss this with the instructor **before** written assignments are due.