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Author(s): MELO 3D Project Team, 2012

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ch216sp12syllabus: Formal Lab Reports

General Information:

- At the top of the report write your name, the experiment number and title, your lab section, and the names of any group members (if it was a group experiment).
- Proofread your report before turning it in. Vocabulary used in chemical laboratory reports is rarely included in spell check programs so pay particular attention to spelling.
- Double-space (or 1.5 space)
- Do not use first person tense, i.e. do not use "I".
- Write objectively, without adding personal qualifications to your analysis. Statements like "the experiment went pretty well" are not appropriate. Negative writing is not objective and should not be used. I.e. avoid making excuses for your data, rather report it as is.

The lab report should be broken into the following sections:

1. Introduction

- Should be 1-2 paragraphs in length.
- The introduction should be the T.V. guide version of the experiment. It should concisely explain to the reader what the purpose/goal of the experiment is, what general concepts are being covered, and mention any relevant laboratory techniques which are being used.
- Any good introduction, whether it be in science or fiction writing, uses a "hook". That is some bit of information or sentence that makes the reader want to keep reading. In your report this could be an interesting piece of background information.

2. Reaction Scheme

- The simple reaction scheme should include starting materials, any reagents and solvents over the reaction arrow and products.
- A reaction scheme is different from a reaction mechanism. It is a summary of the reaction, whereas a mechanism shows step-by-step what is happening using curved arrow notation.
- Use the Chemdraw chemistry drawing program for all structures in your report.

3. Experimental

- Should be written in past tense and be about 1 paragraph long (for each distinct reaction).
- Should be written in paragraph form. Do not use bulleted lists and do not include the reagents table from your lab notebook pages.
- Use proper abbreviations for amounts like grams (g), milligrams (mg), millimoles (mmol) and millileters (mL). Note there is a space between the number and the unit.
- Use the degree symbol when reporting temperatures. A space is used between the number and the degrees sign, but not between the degrees sign and the "C". I.e. 70 ^{o}C .
- All decimal number should have a leading zero before the decimal place (0.5 rather than .5). This is true for tables and calculations in your lab notebook as well.
- Use superscripts and subscripts appropriately.
- Do not use too many details in your experimental section. Things that would be common knowledge for the experimenter, like using a thermometer to make temperature readings, can be left out. Things like extractions are done by chemists every day so details like what layer was aqueous vs. organic are not necessary. A simple sentence such as "the product was extracted from acidic aqueous solution into diethyl ether" is sufficient.
- When giving TLC developing solvents, give them in ratios like 1:1 or 3:2, the actual volume is unimportant.
- The following is an example of an experimental section:

***Ethyl 4-methoxycinnamate**: 4-methoxycinnamic acid (0.60 g, 3.36 mmol) was dissolved in dry N,N-dimethylformamide (10 mL) in a 25 mL round-bottomed flask. Cesium carbonate (1.65 g, 5.06 mmol) followed by iodoethane (1.0 mL, 12.5 mmol) were added. The flask was vigorously stirred and slightly heated at 50 ^{o}C for 1 hour. The product was cooled to room temperature and extracted with a 3:1 solution of hexanes:ethyl acetate. The organic layer was washed with brine, dried with $MgSO_4$, and solvent removed by rotary evaporation. The crude product was recrystallized with 95% ethanol to yield a white solid (0.41 g, 2.30 mmol, 68% yield). ^{1}H NMR (100 MHz, $CDCl_3$) δ7.66 (d, 1H, ^{3}J = 16.0 Hz), 7.49 (d, 2H, ^{3}J = 8.8 Hz), 6.91 (d, 2H, ^{3}J = 8.8 Hz) 6.31 (d, 1H, ^{3}J = 16.0 Hz), 4.26 (q, 2H, ^{3}J = 7.2 Hz), 3.84 (s, 3H), 1.35 (t, 3H, ^{3}J=7.2 Hz). IR (solid KBr, cm^{-1}) v 3406, 2959, 2933, 2874, 1711, 1636, 1605.*

Reporting spectral data: in NMR the first character in paranthesis refers to the splitting (i.e. d = doublet, t = triplet etc.), the second character refers to the

integration (.e. 2H means this signal corresponds to 2 hydrogents in the compound), and the final character refers to the coupling constant. If the coupling constant is note determined it need not be reported here. For IR spectroscopy you need only list those peaks which fall into the functional group region (i.e. 4000-1500 cm^{-1}) unless a peak in the fingerprint region can be easily identified and is useful in identifying the structure.

4. Results and Discussion

- THIS IS THE MOST IMPORTANT SECTION IN THE REPORT
- An effective discussion should uniquely define your experiment while also demonstrating your abiility to select the appropriate data to include, to discuss your understanding of the results in the context of the overall experiment, and to think critically and write logically.
- Should be written in past tense and be 1-2 pages in length.
- Critically discuss your data. The majority of points in this section will be given based on your ability to write logically and to interpret your data appropriately. Talk about any data you were able to collect even if if it is just a TLC plate. If you were unable to obtain data like an IR spectrum, do not go into detail as to why it was unobtainable. A simple statement about poor yielding reaction or time constraints is sufficient. Instead, discuss what you would have expected to see if one were taken.
- Whenever possible you should look up the IR and/or NMR spectra for your starting material and product. These literature spectra should be used in discussion to confirm that the product was made or in identifying an unknown compound (experiments 1, 2 and 5).
- If you attach an IR spectrum, it should be labeled, referenced, and discussed in the report. Simply giving results without discussing, explaining, analyzing them is not sufficient.

5. Conclusion

- Should be written in present or past tense and be 1 paragraph in length.
- Highlight the important results. I.e. was the desired product was obtained and in good purity? if not, explain why.
- How might the experiment be improved if you could do it again?

6. References

- Any outside information that is used in the report should be appropriately cited and arranged in a bibliography at the end of the report.
- Citations and bibliography should be formatted consistently.
- Journals are abbreviated:
- Formatting should be done as follows:
    - Journal articles:
        - Last name, first initial.; last name, first intitial. *Journal*. **Year**, *volume*, pages.

i.e. Deno, N. C.; Richey, H.G.; Liu, J.S.; Lincoln, D.N.; Turner, J.O. *J. Am. Chem. Soc.* **1965**, *87*, 4533-4538.

    - Journals are abbreviated:
        - *J. Am. Chem. Soc. – Journal of the American Chemical Society*
        - *J. Phys. Chem. – Journal of Physical Chemistry*
        - *J. Phys. Chem. A – Journal of Physical Chemistry (A, B, or C)*
        - *J. Org. Chem. – Journal of Organic Chemistry*
        - *Org. Lett. – Organic Letters*
        - *Phys. Rev. Lett. – Physical Review Letters*
        - *Tetrahedron – Tetrahedron*
        - *Tetrahedron Lett. – Tetrahedron Letters*
        - *Acc. Chem. Res. – Accounts of Chemical Research*

    - Web page:
        - Author, if available. Title of page as listed on site. Address of page (date accessed).

i.e. SDBS: IR (Liquid Film), benzene. http://riodb01.ibase.aist.go.jp/sdbs/cgi-bin/direct_frame_top.cgi (accessed Apr 2008).