Research Guidelines
Professor Pojman's Lab
January 2005

Preparation

It is important that you familiarize yourself with the project before beginning work. This means that you not only discuss the project at length with me or your immediate supervisor, but that you also do a thorough literature review of the proposed project and exhibit an understanding the literature you have unearthed. Discuss this with me. In preparation for laboratory work, you must also read the safety handbook entitled *Safety in Academic Chemistry Laboratories* and sign a form stating that you have read and understood this book.

You must be prepared when you come into the laboratory. This means you know what experiment is to be performed and exactly how to do it. You should also be familiar with the possible hazards involved in the experiment and take adequate precautions to minimize these.

Laboratory Performance

You must work an adequate number of hours in the laboratory each week to complete the proposed work (minimum 10 hours/week). Research takes a great deal of hard work and an hour here and there will not suffice for an independent research project. Both your project and your grade will suffer as a result of too few hours in the laboratory.

If you can not make your regularly scheduled time, or will be late then call.

Each week you must email me a 1 –2 paragraph summary of that week's progress (by Monday at 5 PM)

When I email you, you should acknowledge receipt – a simple "OK" will do.

As far as actual laboratory work is concerned, you **must** exhibit good safety technique at all times, e.g. wear protective clothing and safety glasses in the laboratory.

You much wear lab goggles at all time.

Laboratory accidents are usually the result of sloppiness and carelessness. This also means that you must exhibit good laboratory cleanliness, e.g. clean up after yourself, turn off instruments when not in use, etc.

You are strongly encouraged to be creative in the laboratory, e.g., think about any new ideas for experiments, solving existing problems or suggesting alternative interpretations to data. This is what separates scientists from technicians. In addition, you should always use good experimental technique, e.g., think through an experiment beforehand, pipette carefully, use the appropriate controls, etc.

Notebook

Maintain a clear and accurate notebook, recording all the experimental conditions. Calculate concentrations and record them. Do data analysis as soon as possible after performing an experiment. This will make it easier to write-up your results.

Each experiment should have an explicit purpose stated at the beginning. Why are you doing this experiment? What do you hope to accomplish?

Create a table of contents at the beginning of the book, and add to it as you do experiments.

Policy for recording data:

Mark all samples with a code corresponding to the page in your notebook on which the experiment was recorded. Do not use your own "personal" coding scheme. It will mean nothing to your colleagues or me.

The lab notebook is the product of USM. Federal funding agencies require that we keep the notebooks.

e.g. A polymer front tube should be labeled JP1.25 if I recorded the experiment on page 25 of my first lab book. If more there are more than one sample for a page, use .#sample number. JP1.25.2 means the second sample on page 25. Also, the numerical data should be in a Mac file with the same designation.

This way, anyone can pick up a sample, find the experimental conditions and the numerical data.

Nota Bene: This is a non-negotiable policy. No other scheme for labeling samples or files will be tolerated. You will be summarily dismissed if you do not follow this procedure.

Never remove the notebook from the lab except for group meetings.

Getting Along

All members of the group, undergraduate, graduate and visitors, have a right to feel welcome and comfortable working in the lab. Therefore, no negative comments regarding someone's national origin, race, religion, sexual orientation or gender are acceptable in the laboratory or at group functions.

If I or any of your colleagues should say something offensive to you, or say something that makes you uncomfortable to work in the lab, then please inform me immediately.

This is NOT a negotiable policy, nor are there exceptions to this policy.

Computers

You are welcome to use the lab computers for limited personal use except when someone needs them for research work.

Print only what you really need.

No unlicensed software is permitted on the machines. Nor are you permitted to make copies of commercial software for your own use. It is unethical and illegal.

No pornography.

No games.

No piracy of music files or burning audio cd's.

No food or drinks near computers.

Safety

- Any experiment worth doing is worth doing safely. Always make sure you understand the risks associated with an experiment before you perform. If you are unsure, ask me before you do the experiment.
- Experiments with volatile organic compounds must be performed in a fume hood.
- No food or drink in the lab itself.
- No shorts while working with chemicals.
- Wear gloves while working in the lab.. Use the blue disposable gloves for handling organic reagents. Latex gloves do not provide adequate protection.
- Wear safety glasses while working.

Cleaning glassware

Do not use nitric acid to clean glassware.

Clean Up After Yourself!

We all must share the same lab. Clean up your area at the end of each day, and wash all glassware.

Chemical Storage

All solid organic and inorganic chemicals should be stored separately in the chemical cabinets in the back corner of TEC 405. The chemical cabinets are organized alphabetically, and an alphabetical inventory for both cabinets can be found on the G3-AV. Please browse the inventory list before randomly searching through the cabinets, and if you order a new chemical and are unsure of where to store it, please ask.

- Organic solvents are stored in chemical cabinets under the hoods. Acids are kept in a separate storage cabinet under the hoods in TEC 405. All monomers are kept in one of the hoods. Flammable and temperature sensitive chemicals are stored in the refrigerators in TEC 402.

Schedule

Keep a regular schedule of work in the lab. Provide me a schedule of your classes and when you will be in the lab. If you need to go out of town, let me know in advance.

Research Meeting and Presentations
There will be regularly scheduled group meetings. You will be expected to present a 5-10 summary of your work with supporting data, samples and videos. Part of your final grade will be based on the quality of these presentations so take them seriously and be on time.

This will be redundant for most of you, but always good to remember:

Group meetings serve several purposes:

1) They provide you an opportunity to practice making oral presentations.
2) They focus your thinking by making you take a careful look at your work.
3) They apprise me of your progress.
4) They apprise your colleagues of your progress.
5) They allow you to get valuable insights from your colleagues. The whole of our lab's work is greater than the sum of each individuals abilities. I am VERY proud of how well you work together.

When you give an update at a group meeting, here is a general outline:

1. State the overall goal of your project
2. State the particular objective of this week's study.
3. State the hypothesis or question you were seeking to answer.
4. Data (should be on an overhead or a video tape, but always prepared.)
5. Have you answered the question? Why/Why not?
6. State your future plans or what information you need to continue.

For weekly updates, this should be 5-10 minutes. You will also make longer presentations of 30 minutes.

If you are working as a team on a project and want to present the results jointly, that is fine. But I want everyone to speak. It is an essential part of your education.

NB: Spell check your presentations. Grammatical and spelling errors are NOT acceptable. Ask a colleague to review it.

NB: For any compound you mention you must present the chemical structure.

For students in CHE 492 or CHE 496

For 3 credit hours you must work at least 10 hours.

You are receiving academic credit for your work and so you much take 'ownership' of the project. You must take responsibility for understanding the project and become an expert on it.

You must write a prospectus of your project by February 1. The prospectus is a statement of the problem to be solved and why it is important, a review of the relevant literature, a description of the proposed methodology and a description of 'deliverables', i.e., data and samples.

You will be graded on the following criteria:

10% weekly reports (written and oral)
20% Lab notebook
40% actual lab work, including safety, cleanliness, skill
30% final report

To earn an "A", you must demonstrate mastery of the relevant background material. You must work regularly and conscientiously. You must not only do what is asked but also go beyond and think creatively.

In your presentations, emails and final report there are no spelling or grammatical errors. Further, your reports show advanced analysis of your work. Theories proposed are explained well and include the process for falsification, i.e., how the theory could be tested.

You always follow safe lab procedures.

You must keep a legible notebook that includes a table of contents and follows the guidelines.

To earn a "B", you must demonstrate understanding of the relevant background material. You must work regularly and conscientiously. You competently perform the research.

In your presentations, emails and final report there are few spelling or grammatical errors. Further, your reports show accurate analysis of your work.

You always follow safe lab procedures.

You must keep a legible notebook that includes a table of contents and follows the guidelines.

To earn a "C", you do the minimal work required

The Final Report
It is very important that you turn in a well written typed final report before the last day of classes. The report should be of the same format as a standard chemical journal, e.g. Journal of Physical Chemistry. To ensure a good review of the report you are STRONGLY encouraged to submit a draft of your report to your mentor for evaluation at least a week before the final finished report is

submitted. Other helpful reading is a book by Robert Day entitled "How to Write and Publish a Scientific Paper" and *The ACS Style Guide*.

Below are some general guidelines for the final report.

Title Page

Title of Project
Name of Person Submitting
Name of Mentor & Department
Semester in Which Project Was Performed
Date Final Report Submitted

Abstract
State the principal objectives, describe the methods used, summarize the results and state the conclusions. This should be brief, i.e. no more than half a page.

Experimental
The details of your experimental procedures are described in sufficient detail that someone else can repeat them.

Results
This is where the results of your experiment are displayed, e.g. graphs, tables, etc. This is also where any calculations you used are presented, usually in the form of sample calculations. Again, this should not contain any more words than are necessary to describe your experimental results. Graphs and tables should contain an appropriate title and should be easily read (well labeled). Raw data is not normally presented in the report.

Discussion
In this section you should discuss, not simply repeat, the experimental results. If possible, compare your data with known values and results from the literature. This is also the section to explain any problems or "surprises" encountered during the project. If you can think of better or alternative ways to do the experiments, please tell us in this section.

Conclusion
Brief summary of the most significant results and conclusions.

References
Literature cited in the report should be listed here. References should be complete, i.e. should contain authors, title, volume, pages and year of the referenced work. Ask someone how to use ENDNOTE -- a huge timesaver.

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