

LABORATORY SYLLABUS

Print this.

Read this.

Bring this with you to first lab meeting.

All experiment handouts will be available on the CH 142 web page. You will see from the experiment handouts that you are an investigator for Chemical Solutions Incorporated (CSI), an independent consulting firm specializing in solving chemistry-based problems for clients. There are five different CSI clients that you will help, sometimes doing lab work with other CSI investigators and at other times doing the work on your own. Nevertheless, every investigator is responsible for individually presenting his/her results in a professional report to each client at the end of every multi-week experiment.

Instructors:

Dr. Tyler Morin (Keyes 312, x5776, tjmorin@colby.edu) will supervise lab sections B-2 and C
 Lisa Miller (Keyes 310, x5752, lmiller@colby.edu) will supervise lab sections A, B-1, D, & E.

Lab Schedule:

| Week | Date | Experiment Title |
|------|----------------|--|
| 1 | Feb 1 - 3 | No lab meetings |
| 2 | Feb 6 - 10 | I. Chemical Equilibria- Week 1 |
| 3 | Feb 13 - 17 | Chemical Equilibria- Week 2 |
| 4 | Feb 20 - 24 | II. Chemical Kinetics- Week 1 |
| 5 | Feb 27 - Mar 2 | Chemical Kinetics- Week 2 |
| 6 | Mar 5 - 9 | III. Weak Acids and Bases- Week 1 |
| 7 | Mar 12 - 16 | Weak Acids and Bases- Week 2 |
| 8 | Mar 19 - 23 | <i>Spring Break- no labs</i> |
| 9 | Mar 26 - 30 | Weak Acids and Bases- Week 3 |
| 10 | Apr 2 - 6 | IV. Qualitative Analysis of Cations- Week 1 |
| 11 | Apr 9 - 13 | Qualitative Analysis of Cations - Week 2 |
| 12 | Apr 16 - 20 | V. Electrochemistry- Week 1 |
| 13 | Apr 23 - 27 | Electrochemistry - Week 2 |
| 14 | Apr 30 - May 4 | Clean-up, Notebook due, Check-out |

Eye Protection: Safety glasses will be provided for you during the first meeting. You are also welcome to buy and wear higher quality safety glasses. Safety glasses must be worn throughout the scheduled lab, including time spent writing in notebooks or doing computer work.

Keep Your Work Area Safe: Food, drinks, backpacks, coats, etc. belong outside of the lab room; they are not allowed on the floors or bench tops around your work area for safety reasons.

Pre-lab Assignments: Each week there will be pre-lab questions and/or an experiment outline to complete before your lab meets. For multi-week experiments you will do pre-lab assignments EACH WEEK. By answering the pre-lab questions, you will come better prepared to lab and will

be more efficient with your time. Full credit will only be given to pre-lab questions received before 9:00 AM on Friday before the lab meeting for that part of the experiment. For example, the pre-lab questions for the second week of Experiment I are due the Friday before you will actually do the lab work. That means your pre-lab assignment must be received before 9 AM, Friday, Feb. 10th. For partial credit you may have until the following Monday (in this case (Feb. 13th), at noon. You need to do your own work when answering pre-lab questions, even for experiments when you work with a partner (identical pre-labs will be considered a violation of the College's academic honesty policy). Pre-lab questions are to be placed on the shelf of the white bookcase labeled with your lab section in the hallway outside Keyes 310. You must also prepare an experiment outline of the procedure in your lab notebook EACH WEEK before coming to your lab meeting. If you do not come prepared with this procedure you will receive no credit, and you will not be allowed to work in the lab that week.

Laboratory Lecture: Each week, at the beginning of lab, there will be a brief lecture of important information for the experimental work of the day. Be professional by being on time to hear this essential information. Late investigators pay a price in more ways than one.

Late or Missed Lab Periods: You are expected to attend your assigned lab section and to complete every experiment. If you cannot attend your lab due to illness/athletic competition/etc. you must make *prior* arrangements with Lisa Miller otherwise your absence will be unexcused. Lab space and instrumentation are limited; therefore you must make arrangements well ahead of time (at least a week when possible). Only for exceptional circumstances will you be allowed to reschedule more than one lab this term. If you are late to lab (enter after 1:00 PM), you will lose your discretionary point for the day (see below) and will incur late penalties for any work turned in late at that time. If you are ten or more minutes late to your scheduled lab meeting, you forfeit your opportunity to do the lab during that lab period. You must then contact Lisa Miller right away to see if there is an available slot in a lab section meeting later in the week to complete the lab (Lisa will make every reasonable effort to find you such an opening as a courtesy, however, if there is no such opening, you will incur an unexcused absence). Unexcused absences result in a ZERO grade for the missed lab work AND you will still have to complete a lab to pass the CH142 lab. Remember, you must pass the lab portion of CH142 to pass the course.

Discretionary Points: You will begin each week with a discretionary point. You will retain this point by being on time and following proper laboratory procedures (e.g., safety and cleanup). In most cases, coming late to lab will result in an immediate loss of your discretionary point (once the pre-lab lecture begins at 1:00 PM, you are late). You may also lose your discretionary point for safety violations such as not wearing your eye protection. The awarding of points for proper laboratory behavior is meant to be an incentive to help you learn and follow proper practices. Following appropriate safety guidelines are essential to everyone's well being, and we appreciate your cooperation.

Intellectual Responsibility: All written work that you submit (including pre-lab assignments, lab notebooks, client reports & attachments) must be your own work. All answers to questions must be in your own words, and you must perform all calculations yourself, even when working with a partner. Acts such as photocopying material from anyone else's laboratory notebook to include it in your notebook are serious offenses. Note that allowing your own notebook to be

copied is considered to be dishonest as well. Such academic dishonesty will not be tolerated. Therefore, if any notebook/lab paper/pre-lab is found to contain copied work, both the original and the copied notebooks/lab papers/pre-labs will be given a grade of zero and the responsible students will be reported to the CH142 instructor, the department chair, and the Dean of Students' Office.

You need to prepare for your lab time in advance by doing the following:

- Read the experiment before coming to lab. The more prepared you are, the safer and more efficient you will be in lab.
- Write the procedure into your laboratory notebook and complete the Pre-Lab Questions to turn into your lab instructor. Completion of necessary calculations will help you to understand what you are doing both in the lab as well as later when you analyze your data.
- Think about what you need to wear to lab before you come to your lab. No sandals are allowed because your feet need a protective cover over them in case of spills or broken glass. Shoes that allow a lot of exposed skin are NOT what you should be wearing in a chemistry lab. Wearing shorts, skirts, or any clothing that exposes a lot of your skin is not going to be a good idea. We work with concentrated acids, bases, and stain producing reagents this semester. Wear appropriate clothes!

LABORATORY SAFETY

Eye Protection: Safety glasses will be provided for you during the first meeting. You are also welcome to buy and wear higher quality safety glasses. Safety glasses must be worn throughout the scheduled lab, including time spent writing in notebooks or doing computer work.

Keep Your Work Area Safe: Food, drinks, backpacks, coats, etc. belong outside of the lab room; they are not allowed on the floors or bench tops around your work area for safety reasons.

Your lab instructor will indicate when you may begin experimentation each week. No one is to work in the lab alone. You may only work in the lab with authorized supervision.

The chemicals that you will need for each lab assignment will be made available in your work area or in the fume hood as needed. Several of the substances used in this laboratory are hazardous, but when used properly and with caution following the directions given during lab, the chemicals will pose no threat to your health. The laboratory chemicals, glassware, and supplies are provided for your use and for your safety and the safety of others may not be removed from the laboratory without explicit permission from your instructor.

In the case of an accident, **report any spills or breakage** to your instructor at once, so that the appropriate safety measures can be made. DO NOT attempt any chemical clean up on your own. Immediate corrective measures will remove any danger.

In the case of a **fire** involving your clothing use the procedure called **STOP, DROP, and ROLL**. **STOP** what you are doing; **DROP** to the floor, and then **ROLL** over and over to extinguish the flames. Do not run to the fire blanket or safety shower if your clothes are on fire, STOP, DROP, and ROLL first. Someone else will get a fire blanket to further assist you.

The following list of SAFETY RULES applies to everyone working in the General Chemistry lab. For your protection we must enforce all safety rules.

1. Put on safety glasses as soon as you come into the room. They have to be worn the entire duration of lab! Even when you have finished your experiment, keep them on. Other people around you will still be working and even if no one else is in the lab working there is always a potential for spills/breaks/chemical hazards in the lab room.
2. Keep your face well away from reactions. Never watch heating solutions from above; look instead from the sides of the container.
3. Avoid breathing dusts and vapors. Work with volatile liquids in the fume hood.
4. Wash away solutions splashed onto your skin by flushing with copious amounts of water and notify your instructor. Large corrosive spills on clothing may require use of the safety shower. In such a case, notify the instructor who may then direct the quick removal of all contaminated clothing (while you are under the shower). Go to the nearest eye wash station if solution has been splashed into your eyes. Rinse for 10-15 minutes.
5. Transfer a reagent needed for your own use into a container to measure from, taking only about what you need. Never return a reagent taken out of an original container back into that original container.
6. Do not pipet reagents from bottles. Always pour reagent into a labeled beaker and pipet from the beaker.
7. When smelling the odor of a liquid, do not put your nose or face directly over the container. Rather, fan a little of the vapor toward you with your hand. This will protect your nose and lungs from potentially strong smells and harmful vapors.
8. All hazardous waste will be collected in appropriately labeled containers provided for you in the lab. It is against the law to flush many substances down the drain. Ask if you don't know where to put your waste.
9. When your work is completed, clean your work area. Clean used glassware before putting it away. Return borrowed items in better condition than originally found. Wash your hands before leaving lab.
10. Use common sense. Horseplay, practical jokes, unnecessary noise including music downloaded from the web, etc. are not acceptable.
11. Drinks, food, candy, and gum are not allowed in the lab.

MATERIAL SAFETY DATA SHEETS:

The Hazard Communication Standard gives workers the right to know the hazards to which they are exposed. In compliance with this standard, Material Safety Data Sheets (**MSDS**) are kept in

lab for chemicals you will be handling. Each MSDS sheet includes the name of the chemical (or components of a mixture), common names, physical and chemical characteristics, fire and explosion hazard data, reactivity data, health hazards and precautions for safe handling of that substance. A more comprehensive collection of MSDS for all chemicals located in this building is kept on the third floor hallway of Keyes in a clearly labeled bookcase.

Stock bottles of chemicals also contain safety information. This includes chemical name, manufacturer, health, flammability and reactivity hazards. The label also includes specific hazards unique to that chemical (oxidizer, water reactive, etc.). The diamond on some bottles indicates these hazards. The numerals in the boxes of the diamond indicate the severity of the hazard with "0" indicating little or no hazard and "4" indicating severe hazard.

CSI NOTEBOOK GUIDELINES

The Laboratory Notebook: BUY A HARDBOUND COMPOSITION NOTEBOOK TO BRING TO THE FIRST LAB to be your CH 142 laboratory notebook. If the pages in this book are not pre-numbered, then write a number on the top or bottom of each page (book-style, for instance, with 1 on the first page and 2 on the back of that page). On the front cover put your name, "CH 142 Lab," and your lab section. Write "Table of Contents" on the first page to remind you to use it for that purpose each week. You will use this notebook to record all data collected, write procedures, show example calculations, and attach ALL graded work such as pre-labs, reports, report attachments, and grading schemes. When you come to lab you must have this notebook every week in order to work in the lab.

Lab Notebook Essentials: Your notebook serves as a record and proof of each experiment that you do in the laboratory. Your notebook is to be filled in as you do each experiment; you are not allowed to write anything first on another paper and then recopy it into your notebook later. You will not type raw data into spreadsheet and then tape it into your notebook. All raw data is recorded directly into the lab notebook. No lab notebook ever appears perfectly neat, however it must be legible. Write in your notebook with a non-erasable ballpoint pen. When you make a mistake, put a neat line or X through it (NOT multiple lines that make the error unreadable) along with a short note giving the reason why it is not to be further considered (for example, calculation error). Correction fluids such as Wite Out® are not allowed, and it is not acceptable to rip out or leave blank pages. It is also not acceptable to have loose papers hanging out of your notebook. All inserts should be neatly taped in place (no staples!) so that the entire insert is readily visible without unfolding or flipping through pages. The reason scientific notebooks are kept this way is that for research your notebook is your legal proof of your experiments. In fact, in industrial research settings each page is usually signed and dated by the experimenter and a witness each day. Any entries that look suspicious (could have been added or changed later, for instance) may not hold up in court (for example, to decide who first made the ground-breaking discovery that is going to make that person rich). The goal of keeping a lab notebook is to enable anyone to duplicate your experiment based on what you wrote.

Notebook Format: Each experiment should include the following information:

Title; date(s); and lab partner(s).

Objective- Briefly describe the purpose of the investigation in your own words.

Procedure- Prior to coming to lab, prepare an outline of the procedure that you will follow for that day in your notebook. This will be checked as you enter the lab room for sufficient detail. Be sure to record any modifications of the written procedure that arise during the actual experiment.

Data and Observations- Data should be clearly labeled and recorded directly into your lab notebook. For many experiments, the best presentation of data is in clearly labeled tabular form. A sample calculation should be included for each type of calculation, including for those done in spreadsheets.

Supplementary Information- Depending on the experiment, you may be asked to include final forms of data (such as standard curves, etc.). Refer to each experiment for specific requirements.

References- To be professional, you need to have clearly referenced sources for literature values and/or definitions given. For example, if you looked up the reduction potential for the cationic copper ions on the Web Elements web site, the citation should look like this:

Web Elements, <http://www.webelements.com/copper/compounds.html>, accessed 1/31/11.

If you used your textbook for information, then your reference would be presented in the following manner instead:

Brown, Theodore, H. Eugene Lemay, Jr., Bruce E. Bursten, Catherine J. Murphy, Patrick M. Woodard. Chemistry, The Central Science. 12th ed. Upper Saddle River, NJ: Pearson Education, Inc., 2012

Notebook Grading: Your notebook will be collected **once** at the end of the semester for review to make sure that it is a complete record of what you have been doing in lab. It is due when you walk into the room for your last lab meeting (week of April 30th). It will be worth the same as a two-week lab report in combination with lab-clean up tasks completed during that last lab meeting.

CSI Client Report GUIDELINES

Client Report: The report needs to summarize the important points from each experiment in a logical and concise manner at the appropriate level for each client (see the experiment handout for specific information on the client and the experiment). You should also pay attention to the readability of the report (including flow, grammar, and spelling) as we want the client to form a positive impression of you and CSI based on your report. We enjoy creativity, but please make sure that your letter is professionally presented, complete and concise.

Each experiment will require a typed one-page report to the specific client. Line spacing is left up to you. Font size should be 11 or 12. Margin size is left up to you. If your report continues on an additional page ONLY the first page will be graded.

The premise of each client report will vary from experiment to experiment, but in general, you should address all major points of the experiment. You should clearly state any collaborators that worked with you on the experiment. You should describe the nature of the work you did for the client (i.e., your objective in your own words) and in the appropriate context for that experiment. To help the client understand the report, you need to define any applicable underlying chemical concepts and include a brief description of the method(s) used to acquire the results as well as any pertinent experimental observations. Remember to also add a discussion of your conclusions with recommendations for solving the client's problem, along with an error analysis appropriate to the experiment.

Data should be attached to your report in the form of clearly labeled summary tables, graphs, or figures that are referred to in the body of your short report. Each attachment should have a title and a unique number (or letter). For example, Graph 3. Crystal Violet Concentration versus Time. Photocopied notebook pages are not acceptable to attach to a client letter. Remember, someone is "paying" you for your findings, so your presentation should be neat and professional.

Report Grading: Each experiment will be weighted according to its duration. Each experiment grade will also include points for the pre-lab assignment work and instructor discretionary points you've earned.

Late Work: Your client's report & attachments are due prior to the deadline given below, one week following the completion of the entire multiple week experiment. A 25% penalty will be assessed each day the work is late. One minute past the deadline is considered late. Everyone has an entire week to get the client the completed report. Be professional, plan ahead, and don't ask for an extension. **Last minute computer/printer issues are unacceptable excuses to give a client.**

Report Deadlines: for Exp# 1, 2, 3, 4, 5 in order

Lab A: before 1pm Feb 20, Mar 5, Apr 2, Apr 16, Apr 30

Lab B-1: before 8am Feb 21, Mar 6, Apr 3, Apr 17, May 1

Lab B-2: before 1pm Feb 21, Mar 6, Apr 3, Apr 17, May 1

Lab C: before 1pm Feb 22, Mar 7, Apr 4, Apr 18, May 2

Lab D: before 1pm Feb 23, Mar 8, Apr 5, Apr 19, May 3

Lab E: before 1pm Feb 24, Mar 9, Apr 6, Apr 20, May 4