Intermediate Laboratory II: CHEM 342 Spring 2019 Syllabus

Instructor: Kristine Olson, Ph.D.

Meeting times: Tuesday and Thursday 12:30 – 3:50 p.m.

General Information

This course is an integrated, project-oriented laboratory. Lab work in biochemistry and utilization of databases and relevant scientific computer software is included.

Chemistry 342 is an oral intensive course. 25% of the grade is derived from the oral skills evaluations.

Students should purchase ***two*** bound, composition-style laboratory notebooks. Having two notebooks will help with logistics of the Instructor grading an experiment notebook entry while the student has a second notebook available to record data for another experiment.

Useful references for the course are (in addition to the ACS Style Guide)

1. Carl W. Garland, Joseph W. Nibler, and David P. Shoemaker, *Experiments in Physical Chemistry, Seventh Edition* (McGraw-Hill, Boston, 2003).
2. D. A. Skoog and J. J. Leary, *Principles of Instrumental Analysis, Fourth Edition* (Harcourt Brace College Publishers, Fort Worth, TX, 1992).
3. H. M. Kanare, *Writing the Laboratory Notebook* (American Chemical Society, Washington, D. C., 1985).
4. Karin Knisely, *A Student Handbook for Writing in Biology* (Sinauer Associates, Inc. and W. H. Freeman and Company, 2002).
5. John H. Moore, Building Scientific Apparatus: A Practical Guide to Design and Construction, Second Edition (Addison-Wesley, Redwood City, CA, 1989).

Grade Weighting, Lab Report Due Dates

The Grade Weighting for the course is shown below.

In addition to the Student's written work, 5% of the course grade will be subjectively determined by the Instructor as a reflection of observed student behaviors in three major categories: safety, independence, and preparation. Students who need to be reminded about safety issues, students who waste lab time, students whose work is off-task, students who come to lab ill-prepared or are habitually late for class, and so forth will receive low grades in this category.

Unless stated otherwise, lab reports and lab notebooks are due at the beginning of lab.

Oral reports will take ~5 min per person at the start of lab and each student will present one section of an experiment (for example, just the introduction or just the methods section). The Instructor will assign and rotate the sections so each student gets the chance to present each section. The independent project will include an oral presentation of all the experimental sections. For additional details, see the schedule on the last page of the syllabus.

If there is sufficient reason, a student may request an extension. Unexcused late reports and/or notebooks will be downgraded.

Type of Assignment	Assignments Per Section	Possible Points	Points Earned	% of Grade	Adjusted % Points
Lab Notebook	Micropipetting Basics	100			
	Unlocking Color of Candies	100			
	Whose DNA Was Left Behind?	100			
	Cancer Gene Detection	100			
	Clinical Diagnosis of Diabetes	100			
	Survey of Protein Diversity	100			
	Principles of DNA Sequencing	100			
	Intro to PyMol	100			
	NCBI Database Workshop	100			
	Reading Primary Literature & Intr	100		25	
		Total	0		0
Formal Report	Cancer Gene Detection	100			
	Clinical Diagnosis of Diabetes	100		25	
		Total	0		0
Oral Reports	Unlocking Color of Candies	100			
	Whose DNA Was Left Behind?	100			
	Cancer Gene Detection	100			
	Clinical Diagnosis of Diabetes	100			
	Survey of Protein Diversity	100			
	Principles of DNA Sequencing	100			
	Intro to PyMol	100			
	NCBI Database Workshop	100			
	Reading Primary Literature & Intr	100		25	
		Total	0		0
Independent Project	Notebook	100			
	Formal Report	100			
	Oral Presentation	100		20	
		Total	0		0
Lab Safety and Independence	Lab Safety and Independence	100		5	0
				TOTAL	0

Points earned are added together, divided by the # of assignments per section, then multiplied by the % of grade.
The Total (adjusted) will be 100 points. Then use the scale below to see how this translates to a letter grade.

60-63 = D-
64-67 = D
68 & 69 = D+
70-73 = C-
74-77 = C
78 & 79 = C+
80-83 = B-
84-87 = B
88 & 89 = B+
90-93 = A-
94-100 = A

Grading Criteria for Informal (lab notebook) and Formal Lab Reports. These criteria will help you get a rough idea of how lab reports will be graded.

Grade of *A*

Work in the Lab

- Student arrived on time for lab and was prepared to begin lab work without delay.
- Experimental expertise was evident: careful technique was used, and initiative, creativity, and tenacity were apparent when problems arose. Student was enterprising about finding background references, resolving experimental problems, asking

questions, and scheduling her lab work.
- Efficient use was made of lab time, and good lab "housekeeping" was followed. If group work was involved, the team worked well together with everyone contributing.
- Data was entered in the laboratory notebook (see above) simultaneous with observation. Data was entered in tabular form whenever possible. Explanations were given when data was crossed out. Items were well- labeled and appropriate units were affixed.
- Student gave thought to results, *as they were being obtained*, and worked to find problems as they were occurring.
- Calculations were clearly presented and easy to follow.

Lab Write Up

- The lab report guidelines were carefully followed (see guidelines below).
- Report was well-written, and appropriate material was included in all sections. Writing was clear and concise, and arguments were carefully phrased and presented in a logical order. Attention was given to both accuracy and style. (Formal reports are held to a higher standard than informal reports.)
- If unexpected results were obtained, the student made an obvious effort to find out why. Was some of the raw data incorrect due to student error or instrument malfunction, was the experimental design faulty, or were the original expectations incorrect?

Grade of *B*

Work was completed, for the most part, as required for a grade of *A*. However, *one* of the following applied:
- Work was unsatisfactory in one area above.
- Work was mediocre in several areas above.
- There were lots of small problems throughout the report and/or in the way the lab was carried out.
- Report was poorly written, but was excellent in all other respects.
- Report was handed in late.

Grade of *C*
Work was completed, for the most part, in a satisfactory manner. However, there were a number of omissions, the report was generally sloppy and showed insufficient thought, and/or the report was handed in late.

Grade of *D*
Work was completed, but was unsatisfactory in a number of respects.

Grading Criteria for Oral Reports These criteria will help you get a rough idea of how oral reports will be graded
Grade of *A*

- The presentation was well-organized with a good introduction, middle, and conclusion. The presentation told a complete story, and the beginning and end (but not necessarily the middle) of the talk would be comprehensible to the educated non-scientist.
- The use of visual aids was excellent and appropriate to the topic. The student did not simply "read' material from audiovisual aids. She used *PowerPoint* and/or transparencies to show chemical structures, to give equations for chemical reactions, to present data, and to highlight points to be discussed.
- The student appeared to be in command of the material, and was able to answer reasonable questions from the audience.
- The speaker's voice was audible. She established eye contact with everyone in the audience, and got them interested in her subject. The presentation was well-rehearsed, and the speaker did not simply "read" the talk from prepared text.
- She showed up for class on time, and was prepared and ready to start her talk when the audience was seated.

Lower Grades

- See general rationale given above.

Oral Reports – Guidelines

Since CHEM 342 is an oral intensive course, learning how to give formal oral presentations with appropriate audiovisual aids is an important goal of the course. **In all cases an** *Abstract* **of the talk is required (see below).** Students will present their section of the experiment with Powerpoint (other presentation methods can be considered but ask the Instructor if you are considering this). The goal is to have an organized talk that delivers the information efficiently in 5 minutes. In the case of the independent project, each student will present all sections of her own project (intro, methods, results, discussion, etc), and Powerpoint format will be required.

Abstracts of Oral Reports

- A written *Abstract* is required for oral presentations as indicated in the syllabus. The *Abstract* should be handed out to all students and faculty in the course at the time the oral report is given. The *Abstract* should include the following:
- *Title, date, and your name.*
- *A summary of the work accomplished with references*. This should be no more than one-half page in length with 11 to 12 point font, single-spaced, and font styles that are easy to read (Arial, Times New Roman, etc).
- *Reference list* (numbered in order of citation) – 1 to 2 references for abstracts & oral talks related to informal notebook reports. For the formal reports (Expt's 4, 5 and 11) you will need more references.

How to Keep a Professional Laboratory Notebook for Students in Chem 342, Intermediate Lab II – Guidelines

Students are expected to keep a professional laboratory notebook and to bring it with them to *every lab*. Guidelines are given in the *Introduction* of Ref. 1, pp. 1-28.

Setting Up and Using a Lab Notebook. The first thing you should do when you obtain your bound notebook is to label the spine or front cover. Example: *Name*, CHEM 342 – Intermediate Laboratory II, Spring 2019

- Number each page starting with page 1.
- Set up the first page of the notebook as the table of contents. In addition, the first page of each experiment will be reserved for a table of contents (TOC) for that particular experiment (see ahead).
- Reserve the left-hand pages of the notebook for scratch work or for the pasting of computer generated figures, spectra, or graphs.
- The notebook should be kept in ink and be tidy with organized, well-labeled entries. Writing should be clear and concise. *You will be graded in part on writing!*
- Pages should *not* be removed from your lab notebook.

Notebook Entries for Each Experiment or Project. Table of Contents (TOC). Reserve the first few pages for each experiment or project to give the TOC. This will allow you flexibility in your organization. You will fill in the TOC once the experiment is complete.

Your lab notebook should include the following information:

- ✓ Title of the experiment and date the experiment was conducted
- ✓ Introduction
  - ✓ prelab notes, a few background sentences to set the stage for the experiment
- ✓ Materials and Methods
  - ✓ chemicals/reagents used to carry out the experiment
  - ✓ instrumentation and equipment utilized during the experiment
  - ✓ Calculations (these could also go in the results/data)
- ✓ Results
  - ✓ observations made during the experiment
  - ✓ data that was gathered (handwritten or paste in a picture, graph, etc)
- ✓ Daily summary – what needs to be done next time (put this on the left hand side)
- ✓ Conclusions
  - ✓ What do the data tell you?
- ✓ Signature

- Prelab notes (from any prelab lecture) should be entered in your lab notebook. Very often you will find that a detailed set of prelab notes is invaluable in carrying out the experiment and writing up your report.

- Entry of Data and Observations. Above all else, remember that your lab notebook should be an accurate record of what is observed in the lab. Entries should be made as the experiment progresses. *All raw data* obtained at the bench should be entered *directly* in your lab notebook or in a dated computer spread sheet *simultaneous with observation*. *Never* record data on scraps of paper or as scratch work in your lab notebook or elsewhere! *Never* use "white-out" or erase raw data entries in your lab book. If you make an error in your raw data, cross out the erroneous entry with a thin line, make your correction above the crossed-out entry, and explain briefly in the margin the reason for the change in raw data.

- Daily Summary. At the end of each lab period (the last 10 minutes), you should mark off a section in your notebook and write down a summary of what you accomplished for that lab: what goals you met, and what you will need to accomplish (if anything) during the next lab. This section is a note to yourself. If done correctly, this section will allow you to quickly get up to speed in the next lab session. Example of a daily summary: Poured an agarose gel. Need to run samples in the next lab and stain the gel. Note: This will apply to the labs that last more than one day; if a lab is only one day, then this may be irrelevant.

- Calculations and Analysis. Students are expected to begin their calculations and the analysis of their data *while the experiment is underway* and complete the analysis *immediately after* finishing each experiment so that they have time to meet with the appropriate faculty member to go over any questions that may arise. Your data should "make sense." The calculations and/or analysis should be entered in your lab notebook.

- Annotations. Comments on unexpected results, problems, successes, and so on are characteristic of a good lab notebook. If these are entered on an older page of the notebook, they should have the date entered in the right hand margin.

Labeling Chemical Samples. Chemical Samples generated during the course of the semester **MUST** be labeled and the label should be correlated to your notebook. A consistent code will be adopted that will allow anyone who finds an orphaned sample to trace its entire history. In addition to this code, any other information you wish to include on the sample label is fine.

Example: If Jane isolates or generates a chemical compound on March 12, 2019 during lab, and she records the pertinent information on page 33, then her label for the compound should indicate that it is her compound, the particular notebook in which the sample is described, the number of the page on which the description can be found, and the date.

An acceptable label would be: Jane B2-33-CHEM342 Olson, 3/12/19

Jane = Student's Name
B2 = Book #2 of her CHEM342 notebooks
33 = the page number in the notebook
Olson = Instructor's Name
3/12/19 = the date the sample was created.

Filling in the Table of Contents (Once Experiment is Complete). Your final task for each experiment is to fill in your table of contents (TOC) on the first few pages of your entries for the experiment. See ahead for the list of sections needed for your notebook. If you are writing a formal report, the sections in your TOC will follow a standard order (see ahead).

Keep in Mind: a notebook that is a continuum of scribbles and scrawls from cover to cover will waste your time and confuse you when you try to locate information for your write-ups and oral reports. No single system for setting up your notebook will work in all situations so *adopt a flexible attitude.* However, your notebook is a record of your scientific work. If it is unintelligible to an outside reviewer (your lab instructor) then it is as if you never did the work in the first place (= bad grade).

Further Information. A good reference to consult on keeping a professional quality notebook is the book, *Writing the Laboratory Notebook*, by Howard M. Kanare[2].

Informal and Formal Reports for Students in CHEM 342, Intermediate Lab II

Informal and *formal* reports have similar formats, but a formal report should be written using word processing software and the report should be considerably more polished. Guidelines for writing laboratory reports are given in the Introduction of Ref. 1, pp. 1-28.

The *informal* report will be the information you record in your lab notebook. The sections for an *informal* report are added to the experiment entries in the lab notebook, and are referenced in the TOC for the experiment. In some cases the order of sections in an informal report is not exactly the sequence below. The TOC in your lab notebook should make clear where each section is located. (see *"Notebook entries for each experiment or project"* section for what to include in the notebook).

A *formal* report should follow the order below; *be sure to hand in your lab notebook along with your formal report*.

If you wish you may arrange to submit a rough draft to your instructor for critique prior to the completion of your final draft (*several days before it's due*). Note that this does *not* give you an automatic extension of the due date for your report!

The sections required in both informal and formal reports are as follows:

- **Title Page and Abstract.** See p. 14 of Ref. 1 for an example.
- **Introduction.** Your *Introduction* should state the purpose of the experiment, introduce the background info and relevant info to help the reader understand the experiment. Please also discuss any laws, theories, and principle equations used in data analysis (briefly, though, as the details are more relevant in the Methods section). If the material you present is not common knowledge to most biochemists, give references to back up your points (see the *References* section ahead). Your *Introduction* should be one to two pages in length and should place your work in the proper historical context.
- **Materials and Methods.** Cite the lab handout, protocol, and/or published research article(s) that were followed for this experiment. The references will be listed in the *References* section of your report (see ahead for further information). A brief sentence followed by a citation marker is usually sufficient. For example "*The experiment followed the procedure of Jones et al[1] with the following modifications..."*
    - Describe any changes made in the plan from that described in the references.
    - Give the names and model numbers of instruments used.
    - Give the quantities of chemicals used and the source for each chemical.
    - Describe how data analysis was done for this experiment (calculations, etc).
    - Describe any difficulties encountered. If you had to redo a part of the experiment, indicate why.

- **Results.** This section should include ONLY data and observations. Present your data in as complete and terse a form as is possible. Tables, charts, and graphs should be used where appropriate (see *Tables and Figures* section ahead for further information). Be sure to include primary measurements (raw data) as well as derived quantities. Discussions of how the data was obtained are not appropriate for this section and belong in the *Materials and Methods* (see above). Likewise, discussions of the significance of the data belong in the *Discussion* section (see below). Do not present data that is no good if better data was collected later. Sample calculations should be given in an appendix to show clearly the process by which derived results were obtained *beginning from raw data*. It is recommended that you show how a sample data point is carried through *all steps* of your calculations. Computer-generated tables may be attached; they should be well-labeled and include sufficient explanation so that the reader can follow the path from raw data to the final numbers or graphs.
- **Discussion.** The results obtained should be summarized with reference to your tables and figures. A *critical* discussion of the results obtained should be given including sources of error and suggestions for improvement of the experimental method. Students are expected to compare their results with those in the literature or with theoretical values whenever appropriate – AND CITE THE LITERATURE WHERE APPROPRIATE. For Expts 4 and 5, this section will make conclusions about the diagnostic tests based on the data obtained. For the Independent Project, the conclusions will also be based on the data collected to support or refute a hypothesis. If unexpected results are obtained, an effort should be made to find out why! A conclusion or result that involves a calculated value from raw data should include an internal citation to that calculation. For example: ... *in our examination of Tea, Coke, and Pepsi, we found 50 ppm, 72 ppm and 73 ppm caffeine respectively (See Table 1 and Sample Calculation 1)*

- **References.** References should be listed *in the order cited in the text*. If a reference is cited more than once in the text, the original number should be re-used. Works cited are usually published works or formal handouts. If you need to acknowledge the unpublished work of another student or other individual, consult your professor on the appropriate form for the reference. Only references *you actually cite* should be listed: this is *not* a bibliography! If you wish, you may include a *Bibliography* section following your *References*.
- **Tables and Figures.** Tables should be labeled *Table 1*, *Table 2*, etc., and drawings and graphs as *Figure 1*, *Figure 2*, etc. Each table and figure should have a title. If a table or figure is included, it should be cited somewhere in your text. For example, you could say, "Initial Rates data is given in Tables 1-4 and graphs of concentration versus time are presented in Figures 1-4." Tables and figures may either be placed (a) following the paragraph in which they are cited in the text (if there is enough room on the page). (b) following the page they are cited in the text.(c) at the end of the report (but before any appendices), with *all* the tables preceding *all* the figures.
- **Appendices.** Sample calculations and other material that is too detailed for the main body of the report should be included in an appendix.

Writing Be extremely careful in your choice of words. Check to be sure you are really saying what you think you are saying! If your instructor writes "rephrase" in the margin of your report a number of times, you need to work much harder on your writing!! The language of science is quite specific. A major cause of bad writing is incomplete understanding of the concepts and how language is used to describe them. Good scientific writing should be clear, logical, and concise. Use the past tense when describing your lab work and the results you obtained (i.e., "Analysis of the kinetic data indicated that the reaction was first-order."). Scientific laws and theories may be described using the present tense (i.e., "Beers Law states ..."). Proofread your work. Rewrite sections to eliminate repetitive phrasing, awkward transitions, sentence fragments, run-on sentences, and non-parallel construction. Use spell-checking software to catch spelling errors.

Laboratory Schedule A detailed *Laboratory Schedule* for the semester is provided on the last page.

Independent Projects During the designated weeks in the second half of the semester, each student will complete an individual project. Suggested projects will be given to the students, and each student will submit her top choices for projects. Students may also suggest a project idea for consideration. Students will turn in a well-referenced *formal report* on their project, and also give an *oral report.*

Computer Software *Microsoft Word* is the recommended program for word processing, and *Microsoft Excel* for mathematical processing of data, preparing graphs, and doing least squares fits. Learn to use these programs! They will really save you time! Both programs are available on most of the computers in Guion (both on the Macs and the PCs). Be sure to learn how to construct tables and use the equation editor in *Microsoft Word*. Consult the faculty if you are new to this. See the link to "Microsoft Word 'Extras' for Chemists" which you can download off the Course's Moodle Site. *Excel* has a helpful tutorial entitled *Learning Microsoft Excel, which* is highly recommended for inexperienced users. Other useful programs are *PowerPoint* (for giving presentations), *ChemDraw* (for drawing chemical structures) and *Mathematica* (for all types of mathematics). Consult the faculty to find out which computers have this software. *ChemDraw* as an excellent tutorial that should quickly get you up to speed.

Learning Disabilities Sweet Briar College is committed to upholding and maintaining all aspects of the federal Americans with Disabilities Act of 1990 (ADA), as amended in 2008, and Section 504 of the Rehabilitation Act of 1973. If you are a student with a disability and wish to request reasonable accommodations, please contact the Office of Accessibility Services accessibility@sbc.edu for an appointment. Because many accommodations require early planning, requests for accommodations should be made as soon as possible.

Due Dates With the exception of the final project, oral presentations are scheduled for one week after the completion of the lab. Unless you have a documented medical excuse, you will get a **ZERO** for the oral if you fail to present it on the date required. There is no slack time built into the schedule and we will not allow make up orals unless extenuating circumstances prevail. Lab notebooks with entries completed as outlined in detail above and formal reports are due at the beginning of the lab period that follows the oral report –You should turn in your lab notebook together with your formal report. Unexcused late reports and/or notebooks will be downgraded at a rate of 10% each day. After responding to questions at her oral presentation, a student may need to revise her written work. If a student wishes to make extensive revisions, she should consult her instructor and request an extension.

CHEM342 Intermediate Lab II, Spring 2019*

Week of:	Tuesday	Thursday
January 14	**1/15** 1st day – **Check-in,** Biosafety, Exp. 1 Micropipetting Basics *	**1/17** No Lab *
January 21	**1/22** Exp. 2 Unlocking Color of Candies	**1/24** Exp. 3 Whose DNA Was Left Behind?
January 28	**1/29** Exp. 4 Cancer Gene Detection, Day 1	**1/31** Exp. 4 Cancer Gene Detection, Day 2
February 4	**2/5** Exp. 5 Clinical Diagnosis of Diabetes, Day 1	**2/7** Exp. 5 Clinical Diagnosis of Diabetes, Day 2
February 11	**2/12** Exp. 6 Survey of Protein Diversity	**2/14** Exp. 7 Principles of DNA Sequencing
February 18	**2/19** Exp. 8 Introduction to PyMol	**2/21** Exp. 9 NCBI Database Workshop
February 25	**2/26** Exp. 10 Reading Primary Literature & Intro to HPLC	**2/28** Exp. 10 Reading Primary Literature & Intro to HPLC
March 4	**Spring Break – No Lab**	**Spring Break – No Lab**
March 11	**3/12** Exp. 10 Intro to HPLC	**3/14** Exp. 11 Independent Project *
March 18	**3/19** Exp. 11 Independent Project *	**3/21** Exp. 11 Independent Project *
March 25	**3/26** Exp. 11 Independent Project *	**3/28** Exp. 11 Independent Project *
April 1	**4/2** Exp. 11 Independent Project * (catch-up week)	**4/4** Exp. 11 Independent Project * (catch-up week)
April 8	**4/9** Exp. 11 Independent Project oral reports **	**4/11** Last Day of Lab ** **Checkout (Required)**

Scheduling

*** Please note this schedule is subject to change at any time. If lab is canceled due to inclement weather, the instructor will notify the students via email and also communicate how the schedule will be adjusted for remaining lab periods.**

*** Experiment 1 (Micropipetting Basics) will take place on 1/15 instead of 1/17.**

When is stuff due?

- ***All labs (Experiments 1 – 11) will be documented in a composition book, a.k.a. lab notebook.***
- ***Experiments 2 – 11 will have oral presentations* – each student will take 1 part of the lab (i.e. introduction, or methods, etc) and present it to the class in ~5 min. These two items are due 1 week after the lab is completed. Example: a lab completed on a Tuesday is due the following Tuesday. *Exceptions:* Cancer Gene Detection is due 2/12/19 and Clinical Diagnosis of Diabetes is due 2/26/19 (allows students time to revise their formal report based on audience feedback). See below for Indep. Project Info.**
- **Two labs and the Independent Project will require a *formal written report* (typewritten), due 2 weeks after completion: (1) Cancer Gene Detection, due 2/14/19 and (2) Clinical Diagnosis of Diabetes, due 2/28/19.**

*** Independent Project**

- *** The class will be given options on 3/12 that incorporate techniques completed up to that point. Students may also suggest an alternate project. The project will be hypothesis-driven and should be able to be completed in the lab periods allotted.**
- ****Independent Project Oral Report will be on 4/9 at the start of lab. Students will present all sections of their own project. 4/11 can be the makeup day for the oral report if scheduling or project troubleshooting causes a delay.**
- **** Independent Project Formal Written Report is due no later than 11:59 p.m. on Thursday, April 11, 2019 (okay to hand in electronically).**