

Chemistry 446 - Instrumental Analysis

Course Syllabus

Spring 2017

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D2L: Chemistry 446

Office hours: M - 3:00, T - 1:00, W - 2:00, R – 10:00. Other times by appointment.

Class Sessions

Lecture:	M, W	10:00 – 10:50	SCI	A112
Laboratory:	M, W	11:00 – 1:50	SCI	D114
Seminar:	F	2:00 – 3:00	SCI	A121

Course Description

Chemistry 446 is the senior capstone course in chemistry. Students will learn about and use instrumental methods of analysis including spectroscopic, electrochemical, and separation techniques. Oral and written presentations of results from an inquiry-based experiment are required.

Required Materials

Textbook: Principles of Instrumental Analysis, 6th Edition, by Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, Thomson Brooks/Cole, 2007.

Laboratory Notebook: Permanently bound, quadrille ruled.

Calculator: Any scientific calculator.

Lecture

There are two lecture hours per week. During this time we will discuss instrumental methods in a sequence roughly approximating the attached Lecture/Reading Assignment schedule. We will discuss as many different instrumental methods as time allows.

Exams: There will be four hour exams. The hour exams are 100 points. The final exam period will be used for the fourth hour exam and is scheduled for Tuesday, May 16, 2017 from 2:45 pm – 4:45 pm.

Problem Sets: There will be several problem sets distributed during the semester. These problem sets will be handed out in class, along with the due dates. Each problem set is worth 20 points.

Laboratory

The 15 weeks of laboratory will be split between discussions of the theoretical background of instrumental methods, laboratory experiments and an independent research project. Lab experiments will be conducted during weeks 2 - 9. The remaining time during weeks 10 - 15 will be for your independent research project. Refer to the attached Lecture/Lab handouts for the weekly activities during the semester.

In lab we will be working in small groups, and rotating experiments until each person has completed all experiments. Once the final class roster is established, a lab rotation schedule will be prepared that will specify when and with whom you will work each week. The experiments will be placed into two groups of 4 experiments each. I will do everything possible to familiarize you with the instrumentation and theoretical basis for each experiment, but it is critical that you come to class prepared, having read the background material about the experiment you will be conducting. Because many of you already have some hands-on experience with our instrumentation, I will often ask those of you who have used an instrument to serve as in-class experts to assist others in the proper use of the instrumentation. **After an experiment is completed, the instrument must be returned to its rest state (either turned off, or placed on standby as necessary), and the laboratory area surrounding the instrument cleaned and returned to an orderly condition.** Any problems encountered during the period should be reported to me immediately, and recorded in your laboratory notebook. We will meet as a group at the beginning of each lab period to discuss problems and for me to make announcements. **Attendance at this time is required.** Failure to attend any one of these will result in a decrease in your grade as indicated below.

Laboratory Grading: The laboratory grade will be determined in three parts: (1) Laboratory Notebook, (2) Laboratory Reports and (3) Independent Research Project.

Laboratory Notebook: The lab notebook must be a bound notebook in which all data recorded in the laboratory are kept. Twice during the semester these notebooks will be collected and reviewed for 25 points each. **Two points will be deducted for each lab period you miss or are tardy.** Exceptions to this policy may be made on a case by case basis if the reason for the absence is documentable.

To maintain a proper experimental record:

1. The notebook should be permanently bound with consecutively numbered pages.
2. The first few pages should be reserved for a table of contents which must be kept up to date.
3. All entries should be legible and well spaced from one another.
4. Enter data directly **in ink** as they are taken. **Never** recopy numbers or use loose sheets of paper.
5. Cancel errors or rejected data by drawing a single line through them. Do not erase or remove paper. The notebook should be a permanent record of the original laboratory work.
6. Each notebook page should be dated and initialed as it is used.
7. The suggested form of the experimental entries is as follows:
 - a. The title of the experiment and reference as to where the full text can be found.

- b. Clearly identify the sample analyzed along with the number of the unknown, if applicable, and your laboratory co-workers.
- c. The procedure may be written ahead of time.
- d. Enter data on the right side of the page only. Clearly label all entries. To facilitate direct entry of experimental work, it is useful to set up a data page **before** starting the experiment. ALL data collected must be recorded, including weights and volumes used in preparing solutions. Do not presume that you used 1.0 M HCl just because you were told to do so. The lab book should have information on the solutions you actually used.
- e. The left side of the page should be used only for notes to yourself or to attach additional material into your notebook.
- f. At the end of each experiment you should include a results table which lists the best value for the result of the experiment and a statement of the precision (if applicable) attained in the analysis. These result tables can be computer generated and permanently attached to the notebook if that is the way the data are to be evaluated for the reports. A sample calculation is also helpful in illustrating how the results were obtained.
- g. You should include a brief discussion of your results at the end of each experiment.

Laboratory Reports: Each student must submit a laboratory report for each experiment. Each report is worth 25 points and must answer the questions that will be distributed with each experiment. These questions will require that the data be presented and analyzed in specified ways; they will inquire as to how the instrument works, and how instrumental settings affect your results, along with theoretical questions related to the experiment. In addition, the first five reports will include portions of a formal report. For example, Experiment 1 report will include an ABSTRACT of the experiment similar to the ABSTRACT required on a formal report. Reports 2, 3, 4 and 5 will contain the sections INTRODUCTION, EXPERIMENTAL, RESULTS AND DISCUSSION and CONCLUSIONS respectively. Remember that you are advanced chemistry students; your discussions should convey a significant level of scientific sophistication and understanding.

Independent Research Project: Each student will perform a research project during the last five weeks of class.

Research Topic: This is the starting point of your research project and is due February 8 and is worth 10 points. Your research topic must include what instrument(s) you plan to use for your project. If there are too many projects using the same instrument, I may suggest that a different topic be chosen.

Research Proposal: Once you have chosen a research topic you will write a research proposal about your topic. The research proposal is a more detailed description of your research project. It should include what you plan to do, why it is important, what instrument will be used, what are the supplies that you need and their approximate cost, and literature cited. Further requirements for the research proposal will be distributed in class. The first draft research proposal is due February 22 and is worth 30 points. Each research proposal will be reviewed by one of your peers and by me. Based on the comments made by the reviewers, a final draft of the research proposal will be prepared. The final draft is due March 8 and is worth 30 points. When I return your proposal to you with my approval to pursue the research, you must meet with Brent

Speetzen to discuss your complete list of chemicals and supplies needed to complete your project.

Peer Review: Each research proposal will be reviewed by one of your peers. It will be a blind review, with the name of the proposer omitted from the paper. Reviewing a proposal is a confidential matter and you are required to proceed in a professional manner. This includes not discussing the proposal with anyone except with me. The procedure for the review will be distributed in class. The review is due March 1 and is worth 20 points.

Research Paper: Everyone will write a paper on their research project. This paper must adhere to the manuscript requirements of Analytical Chemistry in terms of language used, organization, and formal style of footnotes and bibliography. It is expected that in the introduction of the paper a complete background on the method used and its theory of operation will be included. In addition, 1 point will be deducted for **each** typographical error, and 10 points will automatically be deducted for an incomplete sentence. It is obviously to your advantage to read over your paper carefully and to make good use of your word processor's spell checker. Errors of content, use of footnotes, grammar, etc. will affect the overall grade as will an assessment of readability. If time permits I will, at your request, read and comment on the content of the paper prior to the final submission date. The paper is due May 12 and is worth 100 points.

Seminar

Scientific presentations are important in order to convey discoveries and information about science. This part of the course will focus on oral and poster presentations, since the laboratory portion contains written presentation of scientific material. You will be expected to attend, interpret and present seminars. Your grades will depend on your presentation and organizational skills, as well as your participation and input at the seminars presented by the other students and at departmental seminars. The class will develop the criteria by which your performance on the oral presentation will be judged during the first week of classes. In addition to those developed criteria, my evaluation of your talk will take into account presentation length (time).

Short Talk: A short talk of 9 to 11 minutes duration will be prepared and delivered to the class. The topic of the short talk is your research proposal. Appropriate presentation graphics to illustrate the main points in your presentation must be employed. The audience for this talk is your fellow students. Your talk should use an electronic presentation format such as PowerPoint[®]. You should submit to me an electronic copy of your talk. The visual aids will be graded on completeness, readability and applicability to the talk. The presentations will be presented during class March 6 and 8.

Poster Presentation: You will present a poster of your independent research project. The entire class will display their posters on Friday May 12 from 2 – 3 pm. The poster must be prepared according to ACS guidelines. More details will be supplied as to how these posters are to be prepared and displayed at a later date.

Critiques of all student presentations are required. Each critique consists of filling out a short form that will be developed by the class. The form will be designed to guide the listener to observe and

comment upon pertinent details of the presenter's style and content. The critiques will be collected and a verbatim copy of all comments will be given to each student presenter.

Department Seminars: Attendance is required at all Friday Departmental Seminars, which are held at 2:00 pm in SCI A121. Critiques will also be used to analyze the presentations at these seminars.

Attendance

Attendance at classes is expected, and hopefully will be highly informative. You are responsible for all material discussed or assigned during class. Laboratory attendance and participation is mandatory. Missed labs may be made up only when a legitimate reason for the absence is presented. If you miss a lab and fail to make it up or complete all labs but do not submit one or more reports, you will receive a maximum grade of D. In addition, 2 points will be deducted from the laboratory grade for each day you are late for the pre-lab discussion at the beginning of the lab period unless the absence has been cleared with me in advance of class. Assigned experiments are to be conducted during class time unless prior arrangements are made with me.

Grading

Grading will be based on a total of 1030 points. The total may change as it depends on the number of department seminars.

	Points
Hour Exams (4 at 100 pts each)	400
Problem Sets (3 at 20 pts each)	60
Laboratory Notebook (2 at 25 pts each)	50
Laboratory Reports (8 at 25 pts each)	200
Research Topic	10
Research Proposal – 1 st draft	30
Peer Review	20
Research Proposal – Final draft	30
Research Paper	100
Short Talk	40
Poster Presentation	50
Critiques (8 at 5 pts each)	40
Total	1030

The final grade will be assigned based on a percentage of the possible points, with an A requiring 93%, a B requiring 83%, a C requiring 73% and a D requiring 63%. Actual grades may be "curved", but in no instance will any given letter grade require a higher score than listed above. **A grade of C or better in the course can only be achieved upon successful completion of all 8 laboratory experiments and submission of a report for each. If you earn less than 125 of the possible 250 laboratory points, you will receive a course grade of F.** The + and - designations will be used for borderline scores.

Academic Responsibility

Academic misconduct will not be tolerated. Academic misconduct is defined by the UWSP Handbook Chapter 14.03(1). Anyone who engages in academic misconduct will be subject to disciplinary measures according to the UWSP handbook. The handbook chapter can be found using the following web link: <http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf>.

Disability Services

Students with disabilities should contact the Office of Disability Services during the first two weeks of the semester if you wish to request accommodation.

Religious Beliefs

Religious beliefs will be accommodated according to UWS 22.03 as long as you notify me within the first three weeks of the beginning of classes of the specific days which you will request relief from an examination or academic requirement.

A Few Notes

I am looking forward to a fruitful semester of teaching and learning with you in Chemistry 446. Yes, Chem. 446 is a lot of work. You are senior chemistry majors and you can do it as long as you organize your time and keep up with the deadlines. If you have questions at any time during the semester, you can contact me by phone, email or in person. My class schedule is shown below, so you know when to contact me. Good luck with the semester!

	Monday	Tuesday	Wednesday	Thursday	Friday
08:00					
09:00	Class prep	Research, Class prep	Class prep	Research, Class prep	Research, Class prep
10:00	446 Lec 1 A112		446 Lec 1 A112	Office Hour	
11:00	446 Lab 1 D114	Meeting	446 Lab 1 D114	106 Lab 5 B140	
12:00	446 Lab 1 D114	Research, Class prep	446 Lab 1 D114	106 Lab 5 B140	
1:00	446 Lab 1 D114	Office Hour	446 Lab 1 D114	106 Lab 5 B140	
2:00	Class prep	106 Lab 7 B140	Office Hour	Research, Class prep	Meeting/ Seminar
3:00	Office Hour	106 Lab 7 B140	Research, Class prep		
4:00	Class prep	106 Lab 7 B140			