

Pre-Lab: Thurs 9:15 am – 10:35 am in ST130; Credit 3 units

Lab: Sec 01(Schafer) Monday 1:25 pm-5:25pm in ST349

Lab: Sec 02(Schafer) Wednesday 1:25 pm-5:25pm in ST349

Contact Information: Dr. Julia Schafer, Office: SCST 306, Phone: x8871, Email: jschafer@sandiego.edu

Office Hours: Wednesday 11:15-12:15 am, Th noon-2 pm, Friday 11:15-1:30 pm

Description and Overview of the Course:

Welcome! Analytical Chemistry is the science of chemical measurement. It addresses questions such as, “How do you know how much phosphoric acid is in that Coke?” and “Is there a better way to measure lead in drinking water?” Most of chemistry and much of science rests on our ability to get answers to questions like these. Analytical chemistry itself rests on a foundation of statistics, standards and strategies that allow us to determine the **quality** of our results.

The **pre-lab sessions** (Thursday 9:15-10:35 am) are organized around what you *need to know* to perform the **lab activities**. Pre-labs include lectures, discussions, demonstrations, problem-solving practice, group activities, calculations to perform, one oral presentation and two exams. Lab activities include not only making chemical measurements (“the lab”), but also automating measurements, and using any time this frees up for data analysis, error evaluation, and report writing.

Come to class on time, prepared and ready to participate! Before class, you are expected to have reviewed previous class work and lab data, completed any assignments, and read the material to be covered that day. This course material quickly builds on knowledge from previous classes, so it is important to keep up. Please take advantage of office hours. I also encourage you e-mail questions. **Please allow up to 24 hours for a response.** You will find a calendar for the course on Blackboard, along with laboratory handouts, homework and computer assignments, as well as writing resources.

General Course Goals

Upon completion of this course, you will be able to:

1. summarize and interpret lab results using statistical functions,
2. work skillfully in any type of laboratory,
3. evaluate the quality of a measurement,
4. use the scientific method, and
5. communicate the results of your work in person and in writing.

Specific Course Outcomes

Upon completion of this course, you will be able to:

- select and use glassware properly,
- attach an error term to any measurement and laboratory result,
- apply statistics to assess the precision and accuracy of a measured value,
- keep a complete and useful written record of all your lab work,
- perform accurate and complex titrations
- quantitatively predict the behavior of solutions affected by competitive equilibria,
- make quantitative measurements using the techniques of spectroscopy, chromatography, electrochemistry and kinetics
- make standards for chemical analysis
- build and fully utilize calibration curves
- make buffer solutions at target pH values
- design and execute a sampling plan for a target analyte,
- develop and optimize a measurement method
- automate repetitive tasks/calculations

Required Materials:

- **Textbook:** *Quantitative Chemical Analysis, 9th Ed.*, Harris (W.H. Freeman, 2016)
- **Calculator** capable of scientific notation, exponential and logarithmic calculations, and standard deviations
- **A laptop or tablet device is required**
- **Access to Excel**
- **Electronic Lab Notebook (ELN) \$15** – We will set up your notebook on the first day of lab. You will have three weeks to use the service before paying for it. The cost is \$15. After those three weeks you will be locked out of your notebook. It requires that you bring a laptop or tablet to class in order to have access to the website where your electronic notebook is stored. <https://mynotebook.labarchives.com/>
- **Safety glasses** (must have *side shields* at minimum, available from chemistry club)
- **Lab Coat**

Grading System:

<u>Assignment:</u>	<u># of Points</u>	
Midterm Exam	100	A: 90 % or above
Final Exam	150	B: 80 to 90 %
Lab Work: Prelab, Data/Observation, RA, Dry Labs	500	C: 68 to 80 %
HW Assignments	140	D: 58 to 68 %
Participation Grade	50	F: less than 58%
Oral Defense of Analytical Chemistry Article	60	
Total Points	1000 pts total	

Thursday October 24th 9:15 am – 10:35 am: Midterm exam

Thursday December 19st 8:00 am – 10:00 am: Final Exam

Explanation of Assignments

Reading assignments are given to help you get ready for each class session. While you read, **take notes** on important definitions and concepts. Try the simple problem examples in the text.

There are seven **homework problem sets** assigned along with lecture so that you can practice using the concepts introduced in previous pre-lab sessions. It is important to work through these problems to understand experiment goal, methods and calculations. When you run into a homework problem that you can't solve, don't give up – get help! Come by office hours and check the solution manual. Homework assignments will be due through the electronic lab notebook (ELN) by 11:50 pm on Friday the week they are assigned on the course calendar, unless otherwise noted. See the ELN for instructions, problems sets and due dates.

Exams Two material exams will be given, they are written assuming that you have mastered the basics, and seek to probe cumulative knowledge in the course to date and to evaluate how well you can apply your knowledge to different situations. You may be asked to evaluate the quality of a measurement, solve a problem, or suggest a method of analysis for a certain chemical or system.

Dates for the exams are as follows:

Thursday October 24th 9:15 am – 10:35 am: Midterm exam

Thursday December 19st 8:00 am – 10:00 am: Final Exam

Make-up exams/make-up labs will **not** be possible unless your absence has been approved *in advance*, and you provide *documentation* of the reason for your absence (serious illness, family emergency, interview, participation in USD athletic competition, conference, etc).

Laboratory Experiments The goals of each experiment may vary, but many experiments are designed to help you organize information, find patterns, and construct hypotheses. Data analysis and evaluation are integral parts of each experiment – in fact, it is often impossible to know if you have taken enough data before doing at least some preliminary analysis. For that reason, some experiments will require pre-lab calculations that are graded. It is also important not to **put your brain on “idle”** during lab! Plan to stay in lab the full 4 hours each week so that you can maximize “face time” with your lab partners, instructor, and minimize the work you must finish later. When you finish data collection, work on data analysis or writing.

Lab experiments will consist of one or more of the following:

- Prelab assignment
- Collect data/observations in lab
- Complete a Results and Analysis (RA) section

- Prelab assignment:** Before each lab, you will be asked to do some preparatory work. Typically this involved reading the experiment, preparing your procedure, and doing some type of preparatory calculations. Each prelab should contain at least a brief goal/purpose statement for the experiment, a listing of needed reagents and equipment, a brief preliminary procedure and any prelab calculations necessary for the experiment. Each prelab is worth 5-25 points depending on the length of the assignment. Your **pre-lab assignment must be submitted in your ELN (electronic lab notebook by 11:59 pm** the day before your lab. Late prelabs are worth up to 50% but will not be accepted once the lab starts. You must have your prelab complete before you will be allowed to do the experiment.

Exp	Prelab	Data/ Observations	Analysis and Results/Discussion and Conclusion (RA)	Total
1		10 pts	10 pts	20 pts
2A	20 pts	10 pts		30 pts
2B	20 pts	10 pts	30 pts	60 pts
Dry lab			20 pts	20 pts
3	20 pts	10 pts	20 pts	50 pts
4	20 pts	10 pts	20 pts	50 pts
Dry lab			40 pts	40 pts
5a	20 pts	10 pts		30 pts
5b	20 pts	10 pts	40 pts	70 pts
6a	20 pts	10 pts		30 pts
6b	20 pts	10 pts	40 pts	70 pts
Dry lab			30 pts	30 pts

- Data and Observations section:** All laboratory work is to be recorded in an online **electronic lab notebook**. Record everything that you do **AND why you do it**. All experimental procedures, data and observations *must* be kept within your notebook. The more you write, the better off you will be. As you make updates the lab notebook time stamps every entry you make. You will record all data and observation in lab and submit these for credit at the end of the lab period. No late submissions are allowed.
- Results and Analysis (RA) section:** Each experiment will require follow-up calculations and analysis that will also be recorded and submitted in your **electronic lab notebook in the Results and Analysis section**. Sample calculations and equations should be included and all summary tables and results figures must contain be appropriately captioned. Use narrative to explain the calculations, analysis and results. Due to the nature of using an ELN, you can also attach excel files as appendix for supporting documents. This section will require discussion of quality of results and a conclusion. All lab grades will include points for quantitative error analysis and may also be graded on accuracy. Late “Results and Analysis” will lose 20% for every day that it is late and will receive no credit after 5 days. See the course calendar for specific due dates.

The quality of your lab notebook will comprise part of your grade for each lab report. Quality does not necessarily mean neatness, but it does mean *completeness*. A good notebook will present the experiment in such a fashion that any future Chem 220 student could reproduce your procedure and find your data with only your notebook as a reference.

Class Assignments/Group Work /Participation Points:

There will be opportunities to earn points based on effort, attendance and participation during activities in class.

Academic Integrity:

- *Exams:* By signing an exam, you are stating that you have neither given nor received help on it, and have used only allowed sources (if any).
- It is considered a violation of the Academic Integrity Policy to possess or otherwise use course materials (i.e., lab reports, homework, exams) from previous semesters.
- *Lab reports:* All ideas that are not your own must be properly referenced. Direct quotes must be set off by quotation marks and referenced. Follow these guidelines to avoid plagiarism.
- *Homework:* Homework assignments must be your own work.

Any academic integrity violation is a serious matter and will be dealt with according to the USD Academic Integrity policy.

Attendance Policy

Attendance at your regularly scheduled lab section is **mandatory**. Labs will begin promptly at 1:25 pm. The only reasons for missing a lab that could allow admission to a different section are:

- 1) Serious illness with proper documentation (i.e. doctor's note) or
- 2) Required attendance at an official University event.

However, if you have a conflict (University activity, job interview, etc.) with a scheduled lab day, you need get approval for your absence as far in advance as possible. If your absence does not have prior approval, the missed laboratory session will not be made up and your report grade on that experiment will be prorated downward.

Unexcused absences cannot be made up. If you miss more than one lab in the semester with an unexcused, you will fail the course.

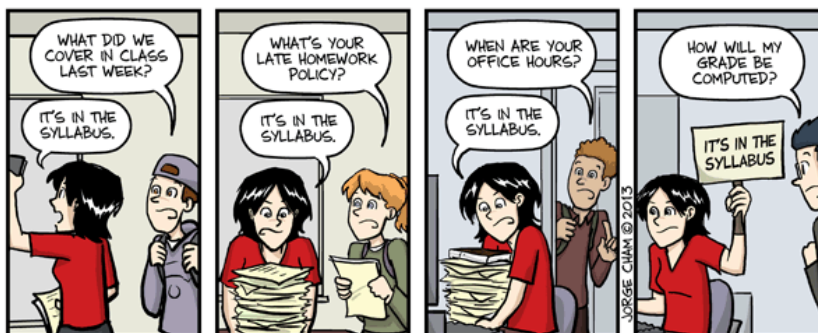
Students with disabilities who believe that they may require accommodations for this class are encouraged to contact Disability Services in Serra 300 (x4655) within the first three weeks of the semester.

IMPORTANT NOTES:

- Allow up to 7-10 days for the return of assignments.
- Coming late to class is disruptive. Please be on time. Attendance will be monitored.
- You are expected to maintain a respectful attitude toward *everyone* in the class.
- Parts of the course are subject to change, to meet the needs of the students.

Piled Higher and Deeper by Jorge Cham

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IT'S IN THE SYLLABUS

This message brought to you by every instructor that ever lived.

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Chem 220 Fall 2019 Tentative Schedule

Week	Prelab Problems	Lab Experiment	Lecture Topic Th 9:15-10:35 am	Reading Assignment	Assignments Due Friday by 11:59 pm
Sept 3-6			Introduction, basic statistics	Review Chapter 1; Read Chapter 0-2, 3.1-3.3, 4.1, 4.3, 4.6	
Sept 9-13		Exp #1: Density of Solutions	<input type="checkbox"/> Protic Acids and Bases (6.5-6.7, 9.1-9.4) <input type="checkbox"/> pH <input type="checkbox"/> Ionic Strength and Activity (8.1-8.3) <input type="checkbox"/> pH probes (15.5)	Read Chapters 6.5-6.7; 8.1-8.3, 9.1-9.4, 15.5	HW #1: Data Camp 1 Notebook
Sept 16 – 20	Prelab Exp#2A in ELN and with EOC problems 9-6, 9-20	Exp 2a: Acids, Bases and Buffers	<input type="checkbox"/> Buffers <input type="checkbox"/> Henderson-Hasselback <input type="checkbox"/> Neutralization Reactions <input type="checkbox"/> Titrations (7.1-7.2, 11.1-11.7) <input type="checkbox"/> Polyprotic Acids	Read Chapters 7.1-7.2, 9.5; 10.1-10.4, 10.10, 11.1-11.7	HW#2: Data Camp #2
Sept 23– 27	Prelab Exp#2B in ELN with EOC problems 9-36, 10-21	Exp 2b: Acids, Bases and Buffers	<input type="checkbox"/> Pooling data: F-test and t-test (4.1-4.5)	Read Chapters 4-2, 4-4, 4-5	HW#3: 9-4, 9-5, 9-26, 10-24, 11-18, 11-45, 11-B
Sept 30– Oct 4		Dry Lab Data Camp = Calculating pH	<input type="checkbox"/> Propagation of Error (3.4-3.5) <input type="checkbox"/> Quality Assurance (5.1-5.2)	Read chapters 3.4-3.5, 5.1-5.2	Results and Analysis Exp #2
Oct 7– Oct 11	Prelab Exp#3 in ELN with EOC problem 4-20	Exp 3: Buffers and Indicators	<input type="checkbox"/> Molecular Spectroscopy (18.1-18.4, 18.6) <input type="checkbox"/> Kinetics and Enzyme Analysis (lecture slides)	Read Chapters: 18.1-18.4, 18.6, p408-410	HW#4: 3-15, 3-22, 4-23, 5-1, 5-3, 5-4, 5-6, 5-A
Oct 14– Oct 17 Friday Oct 18 Holiday	Prelab Exp#4 in ELN with EOC problem 18-12	Exp#4 Glucose by Spectroscopy	<input type="checkbox"/> Method of least squares (4-7) <input type="checkbox"/> Atomic Spectroscopy: Flame, Furnaces and ICP (21-1, 21-2)	Read chapters 4-7, 21-1, 21-2	Results and Analysis Exp #3 10/18 fall holiday
Oct 21–Oct 25		Dry Lab Linear Regression (Will finish most of Exp#4 calculations in class)	Midterm	Read Chapters: 15-1, 17-1 to 17-5, 5-3 to 5-4	Results and Analysis Exp#4
Oct 28– Nov 1	Prelab Exp#5a in the ELN with EOC problem 3-15	Exp 5a: Analysis of Lead Using Atomic Absorbance Spectroscopy	<input type="checkbox"/> Electrochemistry <input type="checkbox"/> Calibration Methods (5-3, 5-4)		HW#5: 4-32, 18-4, 18-7, 18-9, 18-18, 21-6

Nov 4– Nov 8	Prelab Exp#5b in ELN with EOC problems 17-34, 5-25	Exp 5b: Analysis of Lead by Stripping Voltammetry	<input type="checkbox"/> Introduction to Chromatography and Separation Techniques (Ch 23) <input type="checkbox"/> Revisit Quality Control (5.1-5.4)	Read Chapters: 23, 5-4	
Nov 11–Nov 15	Prelab Exp #6a in ELN	Exp. 6a Chromatography bootcamp	<input type="checkbox"/> Liquid Chromatography (25) <input type="checkbox"/> HPLC in-depth: detectors and applications:UV-Vis, Fluorescence	Read chapter 25 (emphasis 25.1-25.3)	Results and Analysis Exp #5
Nov 18– Nov22	Prelab Exp #6b in ELN	Exp. 6b Caffeine Analysis by HPLC Quality Control Analysis	<input type="checkbox"/> How to use Your Online Resources (TBD) Choosing a presentation article <input type="checkbox"/> Mass Spectrometry (22-1, 22-2)	Read chapter 22-1, 22-2	HW #6: 5-23, 5-30, 21-21, 21-23, 23-28
No labs this week - Thanksgiving	11/25-11/29				
Dec 2– Dec 6		Mass spectrophotometry Data Camp	Catch-up /Review		HW#7: 23-51, 25-A, 25-1, 25-13, 25-17
Dec 9– Dec 13		Locker Check-out	Article Presentations		Results and Analysis Exp #6
Final Exam Thursday December 19 8-10 am					