

**University of Wisconsin-Madison**  
**Chemistry 327: Fundamentals of Analytical Science**  
**Fall 2019**

Lecturer: Professor Lloyd Smith  
E-mail: smith@chem.wisc.edu  
Office: Chemistry 4209  
Office hours: after class or by appointment  
Web Site: <https://canvas.wisc.edu/courses/152939>

Laboratory Director: Dr. Pamela Doolittle  
Email: pam.doolittle@wisc.edu  
Office: 535 Service Memorial Institute (SMI)  
Office Hours: Dr. Doolittle has an “open door” policy for meeting with students. Feel free to stop by her office, or email to set up an appointment when seeking help related to the laboratory portion of the course.

Teaching Assistants:

Section	Teaching Assistant	Preferred email
301/601	Caroline Anastasia	anastasia@wisc.edu
302/602	Katie Kruszynski	kruszynski@wisc.edu
303/603	Connor Protter	protter@wisc.edu
304/604	Zhijun (Andrew) Zhu	Zzhu285@wisc.edu

Office hours for all TAs will be posted on the Canvas course page.

Course Credit: 4 credit hours  
Lecture: TR 8:50-9:40 a.m. in B371 Chemistry  
Discussion: W 7:45-8:35 a.m.  
Lab: TR 1:20-4:20

**Official Course Description:** Fundamentals of chemical measurement in chemistry, biology, engineering, geology, and the medical sciences. Topics include equilibria of complex systems, spectroscopy, electrochemistry, separations, and quantitative laboratory technique. Lecture, lab, and discussion.

**Course Designations:** Intermediate level; physical science breadth; counts as L&S credit.

**Instructional Mode:** Face-to-face

**How Credit Hours Are Met:** CHEM 327 is a 4-credit class that meets each week for two 50-minute lectures, one 50-minute discussion, and two 3-hour laboratories. Over the course of the semester, students are expected to engage in at least 180 hours of learning activities, which includes class attendance, reading, studying, preparation, problem sets, laboratory reports, and other learning activities.

**Requisites:** CHEM 104 or CHEM 109

**Course Learning Outcomes:**

Students will be able to

- Apply statistical methods for the evaluation of laboratory data.
- Use calibration and sampling methods important to quantitative analysis.
- Model chemical systems and experimental data using relevant quantitative, mathematical, and computational methods.
- Learn analytical methods based on titrations, separations, electrochemical measurements, and spectroscopy and interpret the results for chemical analysis.
- Identify, formulate, and solve integrative problems using appropriate information and approaches.
- Develop skills in working collaboratively with others, to solve problems and create new knowledge.

**Textbook:** *Quantitative Chemical Analysis*, Ninth Edition, by Daniel C. Harris, W.H. Freeman and Company, 2016.

**Lab Manual:** *A Manual of Experiments for Analytical Chemistry - Fall 2019*, Department of Chemistry, UW-Madison. Lab manuals will be sold in Chemistry room 1375 beginning Wednesday, September 4. WiscCard purchase only—NO CASH SALES.

**Lab Notebook:** Carbonless laboratory notebook with numbered, duplicate pages. Alpha Chi Sigma (AXE), a professional co-ed chemistry fraternity founded here at UW-Madison, will be selling suitable lab notebooks in CHEM 1375.

**Calculator:** A scientific or graphing calculator is required. Only calculators that are permitted on SAT or ACT tests may be used on exams. You may NOT use any stored information, programs, or applications on exams unless given explicit permission.

**Personal Protection Equipment (PPE):** Industrial quality eye protection is required at all times when you are in the lab. Safety goggles can either be purchased from local bookstores or from Alpha Chi Sigma in CHEM 1371. You're also required to wear a laboratory coat at all times in lab; lab coats will be available for WiscCard purchase in CHEM 1371 if you need one. **Students requiring special accommodations in lab should contact the laboratory director, Dr. Pam Doolittle ([pam.doolittle@wisc.edu](mailto:pam.doolittle@wisc.edu)) before the first lab meets.**

**USB Drive:** A USB flash drive that will hold at least 2 GB is required for laboratory.

**Course Web Site:** Assignments, announcements, lecture notes, handouts and homework will be posted on the course web site.

**Problem Sets:** Regular problem sets will be assigned on Tuesdays and will be due the following Tuesday (hand in to your TA in lab).

**Exams:** There will be three exams, each counting equally towards the final grade. The first two exams will be conducted during the scheduled laboratory period, and the third will be given during the regularly scheduled final exam time. The exams will not be cumulative, but will nonetheless draw upon knowledge gained during previous parts of the course.

Exam I: Tuesday October 8, 1:20-2:50 PM, CHEM 1315

Exam II: Tuesday November 12, 1:20-2:50 PM, CHEM 1315

Exam III: Tuesday December 17 (12:25-2:25 PM) (Final exam room – to be announced)

No make-up exams will be given. Students with scheduled classes which conflict with the exams may arrange to take an early exam. Exams will be problem oriented and will test your understanding of both lecture and laboratory material.

**Grading:** The weighting of the various parts of the course in computing your final grade will be: three exams @ 15% each (45%), problem sets (15%) and laboratory/discussion (40%).

### **ACADEMIC INTEGRITY**

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to [studentconduct.wiscweb.wisc.edu/academic-integrity/](http://studentconduct.wiscweb.wisc.edu/academic-integrity/).

### **ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES**

**McBurney Disability Resource Center syllabus statement:** "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA."

<http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php>

### **DIVERSITY & INCLUSION**

**Institutional statement on diversity:** "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." <https://diversity.wisc.edu/>

### **APPROXIMATE COURSE SCHEDULE**

<b>Week</b>	<b>Lecture Topics</b>	<b>Book Chapters</b>
1	Intro, Units, Sig Figs	0,1,3
2	Methods (gravimetric, volumetric, spectrophotometry)	7,18,27
3	Errors, Statistics	3,4
4	Statistics, Spectrophotometry	4,20
5	Spectrophotometry, Fluorescence	18,20
6 (Exam I)	Equilibria	6,8
7	Acid-base	8,9
8	Acid-base	9,10
9	Acid-base titrations	11
10	Titrations (cont)	11
11 (Exam II)	EDTA	12
12	Redox	14,15
13	Electrochem, <b><i>Thanksgiving!</i></b>	14,15
14	Chromatography	23,25
15	Electrophoresis, Mass Spectrometry	22, 26
(Exam III)		

**Laboratory Schedule for Chem 327 (Smith) Fall 2019**

Week	Date	601 Caroline Anastasia	602 Katie Kruszynski	603 Connor Protter	604 Andrew Zhu
1	3-Sep	<b>Last Day off! First meeting of class is Discussion, 7:45 AM Wednesday. See course guide for location details.</b>			
	5-Sep	Check-in/Weighing Lab	Check-in/Weighing Lab	Check-in/Weighing Lab	Check-in/Weighing Lab
2	10-Sep	Volumetric Apparatus	Volumetric Apparatus	Volumetric Apparatus	Volumetric Apparatus
	12-Sep	Standardization of HCl	Standardization of HCl	Standardization of HCl	Standardization of HCl
3	17-Sep	Standardization of NaOH	Standardization of NaOH	Standardization of NaOH	Standardization of NaOH
	19-Sep	% KHP in a Mixture	% KHP in a Mixture	% KHP in a Mixture	% KHP in a Mixture
4	24-Sep	Ascorbic Acid Method	Ascorbic Acid Method	Ascorbic Acid Method	Ascorbic Acid Method
	26-Sep	Spike Recovery and MDL	Spike Recovery and MDL	Spike Recovery and MDL	Spike Recovery and MDL
5	1-Oct	Spec. Det. Of a Mixture	Spec. Det. of a Mixture	Spec. Det. of a Mixture	Spec. Det. of a Mixture
	3-Oct	<b>Finish Labs</b>	<b>Finish Labs</b>	<b>Finish Labs</b>	<b>Finish Labs</b>
6	8-Oct	<b>EXAM 1</b>			
	10-Oct	Study of Fluorescien	Study of Fluorescien	Study of Fluorescien	Study of Fluorescien
7	15-Oct	Adventures with Buffers	Adventures with Buffers	Adventures with Buffers	Adventures with Buffers
	17-Oct	ID of an Unknown Acid	ID of an Unknown Acid	ID of an Unknown Acid	ID of an Unknown Acid
8	22-Oct	Gas Chromatography	Study of Bromocresol Green	Study of Bromocresol Green	High Pressure LC
	24-Oct	High Pressue LC	Gas Chromatography	Hardness of Water	Study of Bromocresol Green
9	29-Oct	Study of Bromocresol Green	High Pressure LC	Gas Chromatography	Hardness of Water
	31-Oct	Hardness of Water	Hardness of Water	High Pressure LC	Gas Chromatography
10	5-Nov	Project Introduction	Project Introduction	Project Introduction	Project Introduction
	7-Nov	<b>Finish Labs</b>	<b>Finish Labs</b>	<b>Finish Labs</b>	<b>Finish Labs</b>
11	12-Nov	<b>EXAM 2</b>			
	14-Nov	Project	Project	Project	Project
12	19-Nov	Project	Project	Project	Project
	21-Nov	Project	Project	Project	Project
13	26-Nov	Project	Project	Project	Project
	28-Nov	<b>Thanksgiving Day--No Lab</b>			
14	3-Dec	Fluoride Ion Electrode	Fluoride Ion Electrode	Silver Electrode	Silver Electrode
	5-Dec	Silver Electrode	Silver Electrode	Fluoride Ion Electrode	Fluoride Ion Electrode
15	10-Dec	<b>Finish labs/Check out</b>	<b>Finish labs/Check out</b>	<b>Finish labs/Check out</b>	<b>Finish labs/Check out</b>
	12-Dec	<b>Study Day--No Classes Scheduled</b>			