

**Course Subject, Number and Title**

Chemistry 327: fundamentals of Analytical Sciences

**Credits**

4 credit hours

**Canvas Course URL** <https://learnuw.wisc.edu/>

**Course Designations and Attributes**

Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Meeting Time and Location**

Lecture: MW 2.25-3.15 p.m. in B371 Chemistry

Discussion: 302, 303 & 304: W 7:45-8:35 a.m. (Location: see time table)

305 & 306: F 2:25-3:15 p.m. (Location: see time table)

Lab: 602, 603 & 604: TuTh 7:45-10:45 a.m.

605 & 606: MW 7:45-10:45 a.m. (Location: All meet MSC 5380)

**Instructional Mode**

All face-to-face

**Specify How Credit Hours Are Met by the Course**

Two lecture periods per week correspond to two Credit Hours

An additional two Credit Hours are dedicated to the two-three hour laboratory meetings scheduled each week.

**INSTRUCTORS AND TEACHING ASSISTANTS****Instructor**

Dr. Lida Khalafi

**Instructor Availability**

Monday 3.30-5 p.m.

Wednesday 3.30-5p.m. or by Appointment

I am in my office many other times during the week and always willing to speak with you if you find me in or make an appointment.

**Instructor Email/Preferred Contact**

khalafi@wisc.edu

**Teaching Assistants**

Section	TA	Preferred Email
302/602	Hongyuan Sheng	hsheng7@wisc.edu
303/603	Rachel Miller	rmmiller22@wisc.edu
304/604	Christopher Sauer	csauer@wisc.edu
305/605	Natalia Spitha	spitha@wisc.edu
306/606	Lisa George	lgeorge4@wisc.edu

**TA Office Hours**

See Learn@UW

**OFFICIAL COURSE DESCRIPTION****Course Description**

Chemistry 327 is an intermediate level analytical chemistry course for non-majors. It emphasizes the 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.

**Requisites**

Chem 104, or 109 or consent of instructor.

**LEARNING OUTCOMES****Course Learning Outcomes**

Students will be able to

- Apply the 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, both chemists and those from other disciplines, to solve problems and create new knowledge.

## 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%). Additional (extra) points up to 5% will be considered for participation and active contribution in class activities.

Exam grading will be based on following scale and may be changed depends on overall class score: A 90.0%, AB 85.0%, B 80.0%, BC 75.0%, C 70.0%, D 55.0%.

## DISCUSSION SESSIONS

Attendance is required. Your TA will provide important pre-lab information as well as answer any questions you may have about labs, homework, or lecture material. To get the most from discussion section, you need to be prepared. It is your responsibility to communicate to your TA the concepts you do not understand and the skills you need to practice. You should ask your TA specific questions and make sure you understand the questions and the answers given by your TA and by fellow students. Bring your lab notebook and manual with you to discussion.

## LABORATORY SESSIONS

The laboratory sessions are a significant and inseparable part of this course. 14 Standard laboratory sessions related to the course content are designed to help you practice and gain proficiency in mastering course concepts, as well as develop specific laboratory techniques important to the field of analytical chemistry. Standard procedures are described in the lab manual. You need to read the procedure and be prepared for each lab session. The online Pre-lab Quiz will be taken prior to lab (on Learn@UW). You will also spend five lab periods conducting experiments for a Laboratory Project.

### Laboratory Notebook

Your lab notebook should include the overview of the experiment, experimental procedure, data from all measurements, at least one complete sample calculation including units and significant figures, results and summary section.

## REQUIRED TEXTBOOK, SOFTWARE & OTHER COURSE MATERIALS

- **Textbook:** Quantitative Chemical Analysis, Eighth Edition, by Daniel C. Harris, W.H. Freeman and Company, 2010.
- **Lab Manual:** A Manual of Experiments for Analytical Chemistry – Spring 2018, Department of Chemistry, UW- Madison. Lab manuals will be sold in Chemistry room 1375 beginning Tuesday, January 23. 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. Indirectly vented safety goggles that completely seal around the eyes and fit over regular glasses 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. You should transport your lab coat in a sealed plastic bag, such as a 1 gallon Ziploc. 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.
- **Laboratory Project**  
For your laboratory project, you will work on determination of ibuprofen as the active pharmaceutical compound of an over the counter drug called Advil, the detail of procedure for the project will be provided. More information regarding the project will be provided later during the semester.

## EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

- Exam I: Wednesday, March 7, 7:15 to 9:15 p.m. (room TBA)
- Exam II: Wednesday, April 11, 7:15 to 9:15 p.m. (room TBA)
- Exam III: Sunday, May 6, 5:05 to 7:05 p.m. (room TBA)

Exams are cumulative in the sense that many of the concepts covered in this course build on one another and a good understanding of earlier material is required for mastering later material.

## Standard Labs

Each of the standard labs is worth 15 points and has three graded components. You must take the online Pre-lab Quiz on Learn@UW prior to coming to lab (6 points). You will be graded on the accuracy of your lab results (5 points), and your lab notebook will be graded for completeness and clarity (4 points). **Please note that for some weeks each lab section has a different lab schedule.** Be sure to check the schedule at the end of this syllabus so that you prepare for the appropriate lab and take the appropriate online Prelab Quiz.

## Pre-lab Quiz

Prior to taking the pre-lab quiz, read about the experiment in the lab manual and prepare your notebook pages. You should be familiar with the overall concepts of the experiment and the methods used in the experiment. You should also understand the procedure and how to do the calculations you will need to do with the raw data. You may attempt the quiz twice and your highest score will appear in the grade book. Note that there is a time limit (usually 30 minutes) for each attempt. The clock begins timing once you start the quiz and you cannot stop and come back later in the day to finish, so be prepared to complete the entire quiz once you begin. Most quizzes have questions that involve calculations, so you should have a calculator, scratch paper, pencil, and your lab manual available when you attempt a quiz. Check your lab schedule to make sure you are attempting the correct quiz. Quiz ending dates and times have been set-up by section and are set to end at 7:40 a.m. the day you are scheduled to do a lab. **Quizzes must be completed before this time or you will receive zero points for the prelab.**

When taking a quiz, **do not include units when entering numbers for computational questions.** The auto-grade feature will not recognize the units and it will mark your answer wrong. In all other parts of the course (lab notebook, homework, exams, etc.) you should always include units. Also be sure to enter the correct number of significant figures for a calculated answer. **An error in the number of significant figures will result in an incorrect answer and zero points for your answer.**

## HOMEWORK & OTHER ASSIGNMENTS

Homework is critical to success in this class and on the exams. You may work together, but do not copy.

Problem Sets: There are 10 homework assignments. Regular problem sets will be assigned on Mondays and will be due at the BEGINNING of lecture the following Monday.

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

## RULES, RIGHTS & RESPONSIBILITIES

- See the Guide's to [Rules, Rights and Responsibilities](#)

## 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.”

## **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/>

## Chem 327: Course Schedule

Week	Lecture Topics	Book Chapters
1 (Jan 24)	Intro, Units, Sig Figs	0,1,3
2 (Jan 29, 31)	Error & Statistics	3,4
3 (Feb 5, 7)	Spectrophotometry	17
4 (Feb 12, 14)	Spectrophotometry, Fluorescence	17,19
5 (Feb 19, 21)	Equilibria	6,7
6 (Feb 26, 28)	Acid-Base	7,8
7 (March 5, 7)	Acid-base	8,9
8 (March 12, 14)	Acid-base titrations	10
9 (March 19, 21)	Titration (Continue) and Project introduction	10
10 (March 26, 28)	Spring break	--
11 (April 2, 4)	EDTA	11
12 (April 9, 11)	Electrochemistry	13,14
13 (April 16, 18)	Electrochemistry, Redox titration	14,15
14 (April 23, 25)	Chromatography	22,23
15 (April 30, May 2)	Chromatography	23,24

## Chem 327 DRAFT Lab Schedule--Spring 2018

Section 602: Hongyuan Sheng

Section 603: Rachel Miller

Section 604: Christopher Sauer

Section 605: Natalia Spitha

Section 606: Lisa George

Week	Date (MW)	Date (TR)	605(MW)	602(TR) and 606(MW)	603(TR)	604(TR)
1	22-Jan	23-Jan	<i>No Lab</i>	<i>No Lab</i>	<i>No Lab</i>	<i>No Lab</i>
	24-Jan	25-Jan	Check-in/ Weighing Experiment	Check-in/ Weighing Experiment	Check-in/ Weighing Experiment	Check-in/ Weighing Experiment
2	29-Jan	30-Jan	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus
	31-Jan	1-Feb	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus
3	5-Feb	6-Feb	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions
	7-Feb	8-Feb	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions
4	12-Feb	13-Feb	Determination of % KHP in a Mixture	Determination of % KHP in a Mixture	Determination of % KHP in a Mixture	Determination of % KHP in a Mixture
	14-Feb	15-Feb	Spectroscopic Determination of a Mixture	Spectroscopic Determination of a Mixture	Spectroscopic Determination of a Mixture	Spectroscopic Determination of a Mixture
5	19-Feb	20-Feb	Ascorbic Acid Method	Ascorbic Acid Method	Ascorbic Acid Method	Ascorbic Acid Method
	21-Feb	22-Feb	Spike Recovery and MDL	Spike Recovery and MDL	Spike Recovery and MDL	Spike Recovery and MDL
6	26-Feb	27-Feb	A Study of Fluorescein	A Study of Fluorescein	A Study of Fluorescein	A Study of Fluorescein
	28-Feb	1-Mar	<i>Finish Labs</i>	<i>Finish Labs</i>	<i>Finish Labs</i>	<i>Finish Labs</i>
7	5-Mar	6-Mar	<b>No Lab – EXAM 1 is WEDNESDAY, MARCH 7 from 7:15-9:15 p.m. (room TBA)</b>			
	7-Mar	8-Mar	Adventures with Buffers	Adventures with Buffers	Adventures with Buffers	Adventures with Buffers
8	12-Mar	13-Mar	ID of an Unknown Weak Acid	ID of an Unknown Weak Acid	ID of an Unknown Weak Acid	ID of an Unknown Weak Acid
	14-Mar	15-Mar	A Study of Bromocresol Green	A Study of Bromocresol Green	A Study of Bromocresol Green	A Study of Bromocresol Green
9	19-Mar	20-Mar	Project Day	Project Day	Project Day	Project Day
	21-Mar	22-Mar	Project Day	Project Day	Project Day	Project Day
10	26-Mar	27-Mar	<b>SPRING BREAK</b>			
	28-Mar	29-Mar	<b>SPRING BREAK</b>			
11	2-Apr	3-Apr	Project Day	Project Day	Project Day	Project Day
	4-Apr	5-Apr	Project Day	Project Day	Project Day	Project Day
12	9-Apr	10-Apr	<b>No Lab – EXAM 2 is WEDNESDAY, APRIL 11 from 7:15-9:15 p.m. (room TBA)</b>			
	11-Apr	12-Apr	Project Day	Project Day	Project Day	Project Day
13	16-Apr	17-Apr	Hardness of Water	Hardness of Water	Hardness of Water	Hardness of Water
	18-Apr	19-Apr	Gas Chromatography	Chemical Oxygen Demand	Fluoride Ion Electrode	Silver Electrode Study of Equilibria
14	23-Apr	24-Apr	Chemical Oxygen Demand	Gas Chromatography	Silver Electrode Study of Equilibria	Fluoride Ion Electrode
	25-Apr	26-Apr	Silver Electrode Study of Equilibria	Fluoride Ion Electrode	Gas Chromatography	Chemical Oxygen Demand
15	30-Apr	1-May	Fluoride Ion Electrode	Silver Electrode Study of Equilibria	Silver Electrode Study of Equilibria	Gas Chromatography
	2-May	3-May	Checkout	Checkout	Checkout	Checkout