

# Chemistry 327: Fundamentals of Analytical Science

## Spring 2017

**Instructor: Dr. Leith Samad**

Office: Chem 2128

Office Hours: See Learn@UW

E-mail: [lsamad@wisc.edu](mailto:lsamad@wisc.edu)

Website: <https://learnuw.wisc.edu/>

**Class Times:**

Lecture: MW 2:25 – 3:15 PM

Labs: MW 7:45 – 10:45 AM

TR 7:45 – 10:45 AM

**TAs:**

Lichen Xiu

Lisa George

Matt Hautzinger

Vila Rajaratnam

Yuzhou Zhao

**Lab Director: Dr. Pam Doolittle**

Office: Chem 2303A

Office Hours: By appointment

Email: [pam.doolittle@wisc.edu](mailto:pam.doolittle@wisc.edu)

### REQUIRED MATERIALS

**Textbook:** Harris, Daniel C., Quantitative Chemical Analysis, 8th ed., W.H. Freeman and Company, 2010. This is available for free online. You do not need to purchase any hard-copy textbook.

**Lab Manual:** A Manual of Experiments for Analytical Chemistry, Spring 2017, Department of Chemistry, UW-Madison; sold in Chemistry building lobby by Alpha Chi Sigma for \$20, NO CASH SALES. You must use your WiscCard to purchase the lab manual.

**Lab Notebook:** Carbonless lab notebook, available at local bookstores and in Chemistry lobby.

**Safety Goggles:** Splash-proof, indirectly vented safety goggles are required at all times when you are in the lab.

**Calculator:** A scientific or graphing calculator is required. The calculator will be used extensively on lab, homework, and exams. 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.

**Course Web Site:** You should frequently consult the course website on Learn@UW. Lecture notes, homework, handouts, and some announcements will all be posted. You will also use the web site to complete online Prelab Quizzes and view grades.

### Grades

**The point distribution is as follows:**

Exams: 3 exams x 120 pts. = 360 pts.

Homework: ~9 assignments x 30 pts = 285 pts.

Laboratory: 15 labs x 20 pts. = 300 pts.

(prelab = 6 pts.; notebook pages = 4 pts.; results = 10 pts.)

Project = 40 pts.

TA evaluation = 15 pts.

Total: 1000 pts.

**The intended grading scale is:**

A:	900-1000
A/B:	880-899
B:	800-879
B/C:	780-799
C:	700-779
D:	600-699
F:	<599

**Caveat:** This scale may be adjusted downward at the end of the semester, depending on the overall class average. It will not be adjusted upward. For example, if you earn a grade of 89.0%, you are guaranteed to get at least an “AB”, and it is possible that you might get an “A”, but you will not get a “B”.

**Review Your Grades:** Your grades will be entered promptly and available for review on the Learn@UW course website. Be sure to review your scores regularly and notify your TA promptly of any discrepancies. *Do not wait until the end of the semester to request corrections.*

**Exams:** Three two-hour exams will be given. The first two exams are evening exams. The third exam will be given during the final exam period.

Exam 1: Wednesday, March 1, 7:15 to 9:15 PM (room TBA)

Exam 2: Wednesday, April 12, 7:15 to 9:15 PM (room TBA)

Exam 3: Sunday, May 7, 10:05 AM to 12:05 PM (room TBA)

**Academic Misconduct:** It is expected that all students will conduct themselves with honesty, integrity, and professionalism. Any student caught engaging in academic misconduct on an exam will receive an F in the course and a written report on their permanent UW record, with possible expulsion from the university. These penalties will also apply for anyone altering an exam after it has been graded and then submitting it for re-grading, or any other form of misrepresentation on an exam. Similarly, copying or fabrication of lab data (unless expressly permitted as part of a group project) or problem sets is prohibited. Any student caught engaging in academic misconduct on a lab, homework, or quiz (for instance, copying another person's work or fabricating data) will receive a zero for that assignment and a written report on their record. A second infraction will result in an F for the course. More information on what constitutes academic misconduct and UW policies on handling misconduct can be found at: <http://www.wisc.edu/students/saja/misconduct/UWS14.html>

**Lecture and Discussion**

**Lectures:** Attendance at lecture is required. Lectures are used to organize the material, outline goals, cover both basic principles and more difficult concepts, and provide illustrations and occasional demonstrations.

**Discussion:** Attendance at discussion is required. Your TA will present important pre-lab information, provide opportunities for problem solving, and answer questions about labs, homework, or lecture material. You should bring your lab notebook and manual to discussion.

**Homework:** There will be ~9 problem sets during the semester. You may collaborate with others or work independently. *If you choose to collaborate with others, you must still work out and hand in your own solutions.* You must indicate on your paper with whom you worked.

Homework will be due at the beginning of the specified period. *No late assignments will be accepted.*

### **Laboratory**

Quantitative chemical analysis is an experimental science and therefore the laboratory is a significant part of the course. You will perform fifteen standard labs involving chemical analyses aimed at teaching you specific skills. The procedures for these experiments are provided in the lab manual. You will also spend about four lab periods working within a group on a special Project Lab. In order to pass the class you must complete all labs, and you must earn a passing grade in the lab.

**Project Lab:** More information on the project will be provided during the semester.

**Standard Labs:** The standard labs are typically worth 20 points and have three components that will be graded. You will do an online Pre-lab Quiz (worth 6 pts) on the Learn@UW web site prior to coming to lab. You will also be graded on the accuracy of your results (10 pts). Finally, your lab notebook will be graded (4 pts) for completeness and clarity. Please note that each lab section has a different lab schedule, especially later in the semester. Be sure to check the schedule on the Learn@UW web site so that you prepare for the appropriate lab.

**Pre-lab Quizzes:** You should read and understand the lab as much as possible before attempting the online Pre-lab Quiz. Please note that there is a time limit (usually 30 minutes) for the quiz. The clock begins once you start the quiz and you cannot stop the clock and return later in the day to finish. So you should be prepared to complete the entire quiz before you begin. If you are not satisfied with your score from your first attempt, you may take the quiz a second time. The higher score from your two attempts will appear in the grade book. Most quizzes have questions that involve calculations, so you should have a calculator, scratch paper, pencil, and your lab manual available when you begin a quiz. Pre-lab Quizzes must be completed prior to your scheduled lab time

**Lab Notebook:** Your lab notebook should include: 1) an overview or purpose statement; 2) an outline of the procedure followed; 3) any relevant chemical reactions; 4) raw data from all measurements; 5) one complete sample calculation including units and proper significant figures; and 6) a results and summary section. The first three items and tables for the raw data should be prepared ahead of time as much as possible. Sample calculations can even be outlined ahead of time. Your results and summary section should be brief. In addition to your final results, it should include comments on whether your data are reasonable and/or any problems that occurred that could affect your results. Someone else should be able to repeat the experiment based on what you've written in the notebook. For more guidelines on proper record keeping, consult the lab manual and textbook. *Copying lab data from another student, unless explicitly part of a group project, is academic misconduct.*

**Lab Reports:** Your lab report will consist of the carbonless copies of the relevant pages from your lab notebook and the completed summary sheet from the lab manual. You will be graded on both the accuracy of your results and the quality of your notebook record. In most cases, the report will be due no later than the beginning of the lab period that follows the student's completion of the experiment. A late penalty of 2 points per meeting period (that is, periods when lab or discussion meet) will be deducted for reports not turned in on time.

**Lab Conduct:** Safety goggles and proper attire must be worn at all times in the laboratory. Labs start at 7:45 AM and you are expected to be on time. Points may be deducted from your lab score for unsafe or sloppy lab practices (such as not wearing goggles or not cleaning up spills) or arriving late. Notify your TA as soon as possible if you must miss a lab for any reason. Labs are very difficult to make up and in all cases must be made up as soon as possible after missing a lab for any reason.

### **Suggestions for Success**

Most students find Chemistry 327 both challenging and rewarding. It is a four-credit course and you can expect to work hard. As an experienced college student you have likely developed a style of learning that has worked well for you. Below are some additional tips that might help you succeed in this course.

- Attend all lectures, labs, and discussions.
- Read the related material in the text book before lecture. Some students find it helpful to take notes on what they've read.
- The textbook is not a novel! If you try to read it as such, you will likely fall asleep. The trick to successfully reading a technical book is to be an "active" reader. Have paper and pencil nearby and use it to take notes and solve problems as you read. Try working examples first without looking at the solutions.
- In the event that you must miss an occasional lecture, be sure to review the TA lecture notes that will be posted on the website. It is also a good idea to borrow notes from a classmate. Every attempt is made to have TA notes posted within 48 hours of lecture; however, occasional delays may occur. These notes are intended to supplement (not replace!) your own notes.
- Review your notes after lectures. Reread the related material in the text book. If there are parts you don't understand, seek help from an instructor or classmate.
- Solve lots of problems! Do all the homework plus extra practice problems. You will become more proficient and do better on exams if you have worked through lots of problems.
- If you often work in a group to do homework problems, be sure to balance that time with independent problem solving. You won't have the group with you during exams!
- Make good use of the office hours offered by Dr. Samad and your TA.
- Seek help promptly if you are confused or have questions. Your confusion will only be compounded by letting it slide. Keep up with the material as last minute cramming is not effective.

**Students with Disabilities:** Students with documented disabilities (McBurney Students) or any special concerns should contact Dr. Samad as soon as possible at the beginning of the semester. Accommodations can be arranged when appropriate for lecture, laboratory, discussion, or exams.

## Chemistry 327 Spring 2017 Lecture Schedule

*(Tentative schedule – topics and order may change as necessary)*

<b>Week</b>	<b>Date (M)</b>	<b>Topic(s)</b>	<b>Chapter(s)</b>
<b>1</b>	16-Jan	Introduction	0, 1, 2*
<b>2</b>	23-Jan	Error & Statistics	3, 4
<b>3</b>	30-Jan	Statistics & Calibration Methods	4, 5
<b>4</b>	6-Feb	Spectrophotometry	17, 18
<b>5</b>	13-Feb	Spectrophotometry & Complexation	19, 11
<b>6</b>	20-Feb	Chromatography	22, 23
<b>7</b>	27-Feb	Chromatography & Equilibria	24, 6
<b>8</b>	6-Mar	Acid-Base Chemistry	8, 9
<b>9</b>	13-Mar	Activity & Acid-Base Titrations	7, 9, 10
<b>10</b>	20-Mar	<b>Spring Break</b>	
<b>11</b>	27-Mar	Systematic Treatment of Equilibria	7
<b>12</b>	3-Apr	Adv. Topics in Equilibria & Calibration Methods (re: Project lab)	5, 12
<b>13</b>	10-Apr	Electrochemistry	13, 14
<b>14</b>	17-Apr	Electrochemistry	14, 16
<b>15</b>	24-Apr	Electrochemistry & Redox Titrations	15, 16
<b>16</b>	1-May	Special Topics & Review	-

\*Readings recommended for review and better familiarity with lab equipment and practices; the content will not be featured on homework or exams.

Chem 327 DRAFT Lab Schedule--Spring 2017

Section 601: Matt Hautzinger

Section 602: Yuzhou Zhao

Section 603: Vila Rajaratnam

Section 607: Lisa George

Section 604: Lisa George

Section 605: Lichen Xiu

Week	Date (MW)	Date (TR)	601(TR) and 604(MW)	602(TR) and 605(MW)	603(TR)	607(TR)
1	16-Jan	17-Jan	<i>No Lab</i>	<i>No Lab</i>	<i>No Lab</i>	<i>No Lab</i>
	18-Jan	19-Jan	Check-in/ Weighing Experiment	Check-in/ Weighing Experiment	Check-in/ Weighing Experiment	Check-in/ Weighing Experiment
2	23-Jan	24-Jan	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus
	25-Jan	26-Jan	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus	Glass Volumetric Apparatus
3	30-Jan	31-Jan	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions	Prep. of Standard HCl & NaOH Solutions
	1-Feb	2-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	6-Feb	7-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
	8-Feb	9-Feb	Hardness of Water	Hardness of Water	Hardness of Water	Hardness of Water
5	13-Feb	14-Feb	Hardness of Water	Hardness of Water	Hardness of Water	Hardness of Water
	15-Feb	16-Feb	Ascorbic Acid Method	Ascorbic Acid Method	Ascorbic Acid Method	Ascorbic Acid Method
6	20-Feb	21-Feb	Spike Recovery and MDL	Spike Recovery and MDL	Spike Recovery and MDL	Spike Recovery and MDL
	22-Feb	23-Feb	A Study of Fluorescein	A Study of Fluorescein	A Study of Fluorescein	A Study of Fluorescein
7	27-Feb	28-Feb	<i>Study Day</i>	<i>Study Day</i>	<i>Study Day</i>	<i>Study Day</i>
	1-Mar	2-Mar	<b>No Lab – EXAM 1 is WEDNESDAY, MARCH 1 from 7:15-9:15 p.m. (room TBA)</b>			
8	6-Mar	7-Mar	Chemical Oxygen Demand	Gas Chromatography	HPLC	Chemical Oxygen Demand
	8-Mar	9-Mar	HPLC	Chemical Oxygen Demand	Gas Chromatography	Adventures with Buffers
9	13-Mar	14-Mar	Adventures with Buffers	HPLC	Chemical Oxygen Demand	Gas Chromatography
	15-Mar	16-Mar	Gas Chromatography	Adventures with Buffers	Adventures with Buffers	HPLC
10	20-Mar	21-Mar	<b>SPRING BREAK</b>			
	22-Mar	23-Mar	<b>SPRING BREAK</b>			
11	27-Mar	28-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
	29-Mar	30-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
12	3-Apr	4-Apr	A Study of Bromocresol Green	A Study of Bromocresol Green	A Study of Bromocresol Green	A Study of Bromocresol Green
	5-Apr	6-Apr	Project Day	Project Day	Project Day	Project Day
13	10-Apr	11-Apr	<i>Study Day</i>	<i>Study Day</i>	<i>Study Day</i>	<i>Study Day</i>
	12-Apr	13-Apr	<b>No Lab – EXAM 2 is WEDNESDAY, APRIL 12 from 7:15-9:15 p.m. (room TBA)</b>			
14	17-Apr	18-Apr	Project Day	Project Day	Project Day	Project Day
	19-Apr	20-Apr	Project Day	Project Day	Project Day	Project Day
15	24-Apr	25-Apr	Project Day	Project Day	Project Day	Project Day
	26-Apr	27-Apr	Fluoride Ion Electrode	Fluoride Ion Electrode	Silver Electrode Study of Equilibria	Silver Electrode Study of Equilibria
16	1-May	2-May	Silver Electrode Study of Equilibria	Silver Electrode Study of Equilibria	Fluoride Ion Electrode	Fluoride Ion Electrode
	3-May	4-May	<i>Check Out</i>	<i>Check Out</i>	<i>Check Out</i>	<i>Check Out</i>