Chemistry 329: Fundamentals of Analytical Science
SYLLABUS

Course Description
Chemistry 329 is an intermediate level analytical chemistry course. Content 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.

Course Credit: CHEM 329 is a 4-credit class that meets each week for two 50-minute lectures, one 50-minute discussion, and two 4-hour laboratories. Over the course of the semester, students are expected to do at least 180 hours of learning activities, which includes class attendance, reading, studying, preparation, problem sets, laboratory reports, and other learning activities.

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

Instructional Mode: Face-to-face

Requisites
Chem 104, or 109 or consent of instructor.

Lecture time: MW 8:50 – 9:40 AM
Lab time: MW 1:20 -5:25 PM
Disc time: F MW 8:50-9:40 AM

Lecture location: Chem B371
Lab location: MSC 5360 & 5385
Disc location: Chem B351, 2311,2307, B371, 2385 (depending on your section assignment)

Instructor:
Prof. *Song Jin*
office: Chem 3363
phone: 2-1562
Office hours: W 12:00 – 1 PM
F 12 – 1 PM
or by appt. (Chem 3363)
e-mail: jin@chem.wisc.edu (Please include "Chem 329" in the subject line.)
Course webpage: https://learnuw.wisc.edu

Teaching Assistants:

Section 321/621	Kyle Czech	kjczech@wisc.edu
Section 322/622	Yutong Jin	yjin58@wisc.edu
Section 323/623	Lichen Xiu	lxiu@wisc.edu
Section 324/624	Chris Jernigan	cjernigan@wisc.edu
Section 325/625	Rachel Bergin	rberbin@wisc.edu

Textbook: Harris, Daniel C. *"Quantitative Chemical Analysis"* 9th Ed.

Other Required Material: Lab manual (available in the Mills Street lobby of Chemistry building), Bound laboratory notebook with carbon copy, safety goggles, a USB or flash drive, and a lab coat.

Learning Objectives for Chem 329:
Students will be able to

a) Apply the statistical methods for the evaluation of laboratory data
b) Use calibration and sampling methods important to quantitative analysis
c) Model chemical systems and experimental data using relevant quantitative, mathematical, and computational methods.
d) Learn analytical methods based on titrations, separations, electrochemical measurements, and spectroscopy and interpret the results for chemical analysis
e) Identify, formulate, and solve integrative problems using appropriate information and approaches.
f) Develop skills in working collaboratively with others, both chemists and those from other disciplines, to solve problems and create new knowledge.
g) Communicate chemical knowledge effectively through written reports, oral presentations, and visual aids.
h) Locate, evaluate, and use information in the chemical literature.

Grades:
The point distribution is as follows:

Exams:	3 exams	55%
Homework:	8 assignments	10%
Laboratory:	12 labs	35%
	12 pre-lab quizzes	
	1 project	
	lab exit survey	
	TA evaluation	
Total:		*100%*

The intended grading scale is:

A	89-100%
A/B	84-88.9%
B	79-83.9%
B/C	74-78.9%
C	68-73.9%
D	60-67.9%
F	<59.9%

However, the scale may be shifted to reflect overall class performance. You will be updated changes to the scale twice during the semester.

Exams:
There will be three exams this semester. The exams are not cumulative; however, most of the material is inherently pedagogical. Therefore, in general you must have a firm understanding of previous material in order to fully comprehend new material. If you have conflicts, please arrange makeup exam sessions with your TA in advance.

Exam I: March 7, Wednesday 3-5 PM (7th week)
Exam II: April 23, Monday 3-5 PM (12th week)
Exam III ("Final Exam"): May 10, Thursday, 2:45 – 4:45 PM

Homework:
You may work on these assignments as a group, but you must turn in your own homework. Be sure to note that the homework assignments directly reflect exam material. If you cannot work out the problems yourself after the completion of the homework, you will not gain the *proficiency* required to solve the problems on the exams within the timeframe of the exams. **Homework will be usually due on Mondays at the beginning of lab sessions. No late assignments are accepted. This is a strict deadline.**

Course Outline:
The tentative course schedule is as follows:

Week	Lecture Topics	Book Chapters
1 (Sept 6 -Wed)	Intro	0, 1
2 (Sept 11)	Units, Errors	3, 4
3 (Sept 18)	Statistics	4
4 (Sept 25)	Spectrophotometry	18, 19
6 (Oct 2)	Spectrophotometry,Equilibria	20, 6
7 (Oct 9)	Acid-base	8, 9
8 (Oct 16) (Exam I)	Acid-Base	9, 10
9 (Oct 23)	Acid-base titrations, Project Intro	7, 11
10 (Oct 30)	Titrations, Systematic treatment	11, 8
11 (Nov 6)	Activity, EDTA	13, 12
12 (Nov 13)	Redox, Electrochemistry	14
13 (Nov 20) (Exam II)	Electrochemistry	15
14 (Nov 27)	Electrochemistry, Chromatography	15, 23
15 (Dec 4)	Chromatography	24
16 (Dec 11)	Chromatography, Review	24, 25

This schedule will change as we go along, depending on how we do in these lectures. You should also note that textbook chapters 0, 2, and 27 are devoted to analytical laboratory practices. Although you will not be directly tested on these chapters, you may find information in these chapters that will boost your performance in the laboratory.

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/.

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/

Laboratory:

The laboratory counts for a total of 35% towards your final grade and is divided into three main categories: standard experiments, lab quizzes, and project.

- There will be 12 graded standard experiments, and your grade will be based on the accuracy and precision of your results. **The results from these experiments are to be turned in no later than the start of the laboratory period following the completion of the experiment.** You will lose 4 pts/day if the result is turned in late.
- The primary goal of the pre-lab quizzes is to prompt you to prepare for the labs beforehand and to test your knowledge and understanding of the concepts behind the standard experiments. Overall, being "prepared" for a lab means you are familiar with the: overall concepts and goals of the experiment, methods used in the experiment to accomplish the goals, procedure (enough so that you understand the impact of each step on the chemistry and the calculations, e.g. dilutions, stoichiometry, etc), and calculations (enough so that you understand how to perform the calculation required for the experiment given a set of raw data). You can have two attempts at each quiz, the higher grade will be the final grade. It is advised that you make your first attempt for each quiz at least 1 day before the lab so that you have time to ask questions before your second attempt, in case you encounter any difficulties. **The quiz for each lab becomes unavailable when that lab starts.**
- The lab project could be the most challenging and also most rewarding part of this course. We will discuss the project in more details as we go into the semester.

Week	Date	621 Kyle Czech	622 Yutong Jin	623 Lichen Xiu	624 Chris Jernigan	625 Rachel Bergin
1	22-Jan	***No classes***				
	24-Jan	Check-in/Weighing	Check-in/Weighing	Check-in/Weighing	Check-in/Weighing	Check-in/Weighing
2	29-Jan	Volumetric Apparatus	Volumetric Apparatus	Volumetric Apparatus	Volumetric Apparatus	Volumetric Apparatus
	31-Jan	Standardization of HCl	Standardization of HCl	Standardization of HCl	Standardization of HCl	Standardization of HCl
3	5-Feb	Standardization of NaOH	Standardization of NaOH	Standardization of NaOH	Standardization of NaOH	Standardization of NaOH
	7-Feb	Determination of % KHP	Determination of % KHP	Determination of % KHP	Determination of % KHP	Determination of % KHP
4	12-Feb	Spectrophotometric Det. Of Fe	Spectrophotometric Det. Of Fe	Spectrophotometric Det. Of Fe	Spectrophotometric Det. Of Fe	Spectrophotometric Det. Of Fe
	14-Feb	Hardness of Water	Hardness of Water	Hardness of Water	Hardness of Water	Hardness of Water
5	19-Feb	Adventures with Buffers	Chemical Oxygen Demand	Adventures with Buffers	Chemical Oxygen Demand	Adventures with Buffers
	21-Feb	Chemical Oxygen Demand	Adventures with Buffers	Chemical Oxygen Demand	Adventures with Buffers	Chemical Oxygen Demand
6	26-Feb	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment
	28-Feb	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment
7	5-Mar	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment	Project--Design Pb Experiment
	7-Mar	*Exam 1*				
8	12-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	ID of an Unknown Weak Acid
	14-Mar	Bromocresol Green	Bromocresol Green	Bromocresol Green	Bromocresol Green	Bromocresol Green
9	19-Mar	Project Planning Day	Project Planning Day	Project Planning Day	Project Planning Day	Project Planning Day
	21-Mar	Practice with ImageJ	Practice with ImageJ	Practice with ImageJ	Practice with ImageJ	Practice with ImageJ
--	26-Mar	***Spring Break***				
	28-Mar					
10	2-Apr	Project	Project	Project	Project	Project
	4-Apr	Project	Project	Project	Project	Project
11	9-Apr	Project	Project	Project	Project	Project
	11-Apr	Project	Project	Project	Project	Project
12	16-Apr	High Pressure Liquid Chromatography	Project	Project	Project	Project
	18-Apr	Project	High Pressure Liquid Chromatography	Ag Electrode Study	Fluoride ISE	High Pressure Liquid Chromatography
13	23-Apr	*Exam 2*				
	25-Apr	Fluoride ISE	Ag Electrode Study	High Pressure Liquid Chromatography	Ag Electrode Study	Fluoride ISE
14	30-Apr	***Project Presentation***	***Project Presentation***	Fluoride ISE	High Pressure Liquid Chromatography	Ag Electrode Study
	2-May	Ag Electrode Study/Check-out	Fluoride ISE/Check-out	***Project Presentation/Check-out***	***Project Presentation/Check-out***	***Project Presentation/Check-out***