

Analytical Instrumental Laboratory

CHEM 314W; Spring 2016

Course Name: CHEM 314W, 3 credits, writing intensive
Prerequisites: CHEM 212, 332 (co.)
Location: Reichardt 138 (lecture); Reichardt 245 (lab)
Meeting Time: M 9:15-10:15am (lecture), TR 8-11am (lab)
Final: Wednesday, May 4 8-10am (based on lab meeting time)



Instructor: Dr. Sarah Hayes
Office: Reichardt 188
Phone: 907-474-7118
Email: s.hayes@alaska.edu
Office Hours: By appointment, or drop by when my door is open

Course Website: <http://instrumentalanalysis.community.uaf.edu>

Blackboard Link: <http://classes.uaf.edu>; **emails and grades only.**

Recommended Materials:

Skoog, Holler and Crouch, **Principles of Instrumental Analysis**, 6th ed. (978-0495012016)

Harris, **Quantitative Chemical Analysis**, 8th ed. (978-1429218153).

**** Current editions of textbooks on reserve in Rasmussen Library for 2 hr in-library use****

Course Description: A laboratory course focusing on the acquisition and interpretation of chromatographic and spectroscopic data for quantitative chemical measurements. Students will learn effective experimental planning and execution, critical evaluation of experimental data and written communication in the context of the chemical sciences. Much of this course is student-directed and project based. Students are expected to carefully prepare, plan, and execute experiments with minimal instructor input. CHEM 314W builds on previous experience with analytical chemistry (eg CHEM 212). This course is also writing intensive and requires the completion of ENGL 111X, 211X, and/or 213X.

Instructional Methods: This class is based on characterizing a product given to each student on the first day of class. Throughout the semester, students will use a variety of instrumentation to characterize different parts of their product both individually and in groups. In lecture, students will learn to correctly apply, diagram, and troubleshoot instruments. They will apply this knowledge in lab by designing experiments and learning to use instruments to characterize their product. After each experiment is completed, written reports will be submitted for instructor and peer review. A final report, largely a revised version of previous reports, and poster will showcase student accomplishments.

Course Goals: Students will learn to design an experiment, select appropriate instrumentation, research and apply laboratory procedures, carry out experiments, troubleshoot instruments, analyze data, and write it all up in a scientific report.

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Student Learning Outcomes:

- Students will be able to diagram spectroscopic and chromatographic instrumentation and select the appropriate instrument for a particular problem.
- Students will be able to research and apply instrumental methods for characterizing materials. Then perform the experiment and interpret the results.
- Students will compose a scientific report in the ACS style to justify and document experiments, interpret results, and draw conclusions.

Available Instrumentation: XRF, Flame AA, ICP-MS, FT-IR, calorimeter, UV-Vis, electron microscopy, GC-MS, HPLC, XRD, NMR.

Course Policies:

Continued attendance to class indicates each student agrees to the policies set forth in this syllabus.

Behavior and Collaboration- Students are expected to conduct themselves professionally at all times. Disrespect of the classroom learning environment, instructors, and fellow students is not tolerated! Collaboration and working in small groups is a key component of classroom and lab time.

Attendance, Tardiness, and Late Work- Students are expected to attend class and not compromise the experience of other students. Makeup labs are not available for this course except for school-related travel. Work is not accepted late. This is to keep us all moving through the material efficiently.

Instructor-Initiated Withdrawals- Any time up to and including the final date to drop a course with a "W," the professor has the right to withdraw a student that "...has not participated substantially in the course."

Honor code and Academic integrity- Students are expected to conduct themselves in accordance with the UAF Honor code. The Chemistry Department policy states: *Any student caught cheating will be assigned a course grade of F. The student's academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.*

Disability Services- I will work with the Office of Disabilities Services (208 Whitaker Bldg, 474-5655) to provide reasonable accommodation to students with disabilities. It is the student's responsibility to make an appointment with me to discuss appropriate accommodations. A letter from disabilities services must be provided.

Veteran Support Services- Walter Crary (wecrary@alaska.edu) is the Veterans Service Officer at the Veterans Resource Center (111 Eielson Building, 474-2475). Fairbanks Vet Center 456-4238. VA Community Based Outpatient Clinic at Ft. Wainwright is 361-6370.



CHEM 314 Evaluation

There are **1020 total points available** in this class. Grades are assigned on the typical scale 1000-900 A, 899-800 B, 799-700 C, etc.

Assignment	Points
Project definition	50
Experiments	500
Lab notebook	50
Poster presentation	50
Final report	50
Exams (2@100 each)	200
Standard Addition and Throughput	100
* Extra credit* Resources (5 ea up to 20 pts)	*20*
Total points graded	1000

Consumer Product Characterization Project

Characterize flavors, odors, colors, plastics, and metals in a consumer product. This is a semester-long project during which you will learn to write procedures, use, and troubleshoot many different instruments with the final goal of collecting data to determine what is in your product. **Additional details on the expectations for each assignment is available on the website.**

Project Definition- (50 pts; group) A 3-5 pg report designed facilitate learning about your product and develop a plan for addressing your questions.

Experiments (500 pts; individual & group)- Experiment requirements vary throughout the semester (details below and on website).

Experiment	Report	Points
Experiment 1: Elemental Analysis	Full report- group	100 pts
Experiment 2: Plastics	Short report- individual	50 pts
Experiment 3: Colors	Full report- individual	100 pts
Experiment 4: SEM	Short report- individual	50 pts
Experiment 5: CYOA	Full report- individual	100 pts
Experiment 6: Separations	Full report- group	100 pts
Total		500 pts

Poster and Oral presentation (50 pts, group)- Share what you learned in your project with the public. Posters will be presented at the department poster session at the end of the semester.

Final report (50 pts, group)- Bring it all reports together into the final report.

Exams (200 pts)- Midterm and Final Exams will count for 100 points each.

Standard Addition and Throughput Experiments (100 pts)- Additional experiments scheduled at the beginning and end of semester to expose students to material not covered in the CPCP.

Resources (Extra Credit- 5 pts each, up to 20 pts)- Add useful resources (books, ebooks, websites, anything) to the class website by posting a response on the appropriate analysis pages. Whatever you find and post must be accessible to the entire class. **These contributions are only accepted before the applicable report is due.**

REVIEW SAFETY FEATURES IN THE LAB (REIC 245)

- Cubbies for bags and coats
- Location of personal protective equipment (PPE)
- Safety shower/eyewashes
- Fume hoods
- Exits out of room and out of building
- Waste bottles and broken glass container(s)
- Chemical/safety literature
 - hazard.com/msds is a good start

LABORATORY SAFETY RULES

- USE COMMON SENSE AT ALL TIMES!!!
- No horseplay in lab
- No unauthorized experimentation
- Wear safety glasses/goggles—know when each is required
- Use of correct gloves (when appropriate)
- Knowledge of location and use of MSDS's
- NO food, drink, or gum in lab
- Do not leave fires unattended
- Label all containers with contents, your name, your class, and date/semester
- Report any accident or spill or unsafe condition
- Observe proper storage of chemicals
- Properly disposing of laboratory waste
- Use caution around heat sources, cold sources, flame, electrical equipment
- Properly disposing of glass
- Safely handling chemicals
- No open-toed shoes, no shorts in lab
 - Recommend no skirts, hair tied back, no loose sleeves/clothing

OTHER IMPORTANT RULES

- This is shared lab space
 - Clean up after yourself
 - Follow storage rules
 - “Default Dirty” Assume benches/glassware is not as clean as you would like.
- Wash your hands frequently
- LABEL EVERYTHING!!!!
- Use caution if you must transport samples to other rooms
- Inform your instructor and/or TA if you use the last of something or break something
- You are responsible for your own safety, and the safety of everyone else in this room

GOOD SAFETY = GOOD LAB TECHNIQUE = GOOD RESULTS

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Date		Monday Lecture	Tuesday Lab	Thursday Lab
1-11	0	No class	No class	Introduction
1-18	1	No class	Introduction to Measurements (Ch 1) Standard Addition Due: Ungraded Writing Assessment	Noise and Error (Ch 5) Planning safe experiments Standard Addition
1-25	2	Interactions b/w light and matter (Ch 6) Project overview	Beer's Law (Ch 13) Standard Addition	Metals: sample destruction, XRF Due: Exp 1 Prelab 1 Qs
2-1	3	Components of instruments (Ch 7) Due: Standard Addition Experiment	Atomic spectroscopy (Ch 8-11) EXP 1: Metals: dissolving samples	EXP 1: Metals: Flame AA Due: Exp 1 Prelab 2 Qs
2-8	4	Molecular spectroscopy (Ch 13-15) Due: Exp 1 Annotated Figures 1	EXP 1: Metals: Flame AA 10:30 ICP-MS tour	Writing a procedure EXP 1: Metals: ICP-MS
2-15	5	Vibrational Spectroscopy (Ch 16-18) Due: Project Overview	EXP 2: Plastics sample preparation Due: Exp 3 Procedure	EXP 2: Plastics: FT-IR
2-22	6	Electron Microscopy (Ch 21-ish) Due: Exp 1 Annotated Figures 2	EXP 3: Colors & Calories Due: Exp 2 Final Short Report	EXP 3: Colors & Calories Due: Exp 5 Procedure
2-29	7	X-ray techniques (Ch 12); Peer review Due: Exp 1 Group Report	EXP 3: Colors & Calories Due: Exp 3 Annotated Figures	EXP 4-5: SEM/CYOA Due: Exp 1 Peer Review
3-7	8	Exam 1 Due: Exp 6 Procedure	EXP 4-5: SEM/CYOA Due: Exp 3 Individual Report	EXP 4-5: SEM/CYOA Due: Exp 1 Rev. ; Due: Exp 3 Peer Rev.
3-14	Spring Break			
3-21	9	Chromatography (Ch 26) Due: Exp 4: SEM Short Report	EXP 5: CYOA Due: Exp 5: CYOA Annotated Figures	EXP 6: Separations: GC-MS/HPLC Due: Exp 3 Revisions
3-28	10	Mass spectrometry (Ch 11, 20) Due: Exp 5 Report	EXP 6: Separations: GC-MS/HPLC	EXP 6: Separations: GC-MS/HPLC Due: Exp 5 Peer Review
4-4	11	Separations Instrumentation (Ch 27, 28) Due: Exp 5 Revisions	EXP 6: Separations: GC-MS/HPLC	EXP 6: Separations: GC-MS/HPLC Due: Exp 6 Annotated Figures
4-11	12	Applications of Separations	Throughput: Initial measurements Due: Poster draft 1	Throughput: Review optics Due: Exp 6 Individual Report
4-18	13	Review monochromators & Beer's Law Due: Exp 6 Peer Review	Throughput: Electronics (Ch 2-4) Due: Throughput Experiment	Poster revision Due: Poster draft 2
4-25	14	Review of Spectroscopic Instruments Due: Poster final draft	Poster presentations	4-28, 3-5pm Poster Session- Potluck
5-2	15	Exam Review Due: Final Report by 5pm		May 4, 8-10 am Final Exam Based on lab meeting time

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Assignment Due Dates

Assignment	Procedure	Experiment	Annotated Figs	Report	Peer Review	Final
Ungraded writing assessment						1-19
Standard addition						2-1
Project overview						2-15
Exp 1: Elemental analysis	Prelabs: 1-28, 2-4	1-28 to 2-11	2-8, 2-22	2-29, group	3-4	3-10
Exp 2: Plastics	--	2-16, 2-18	--	Short report: 2-23		
Exp 3: Colors and calories	2-16	2-23 to 3-3	3-3	3-8, individual	3-10	3-24
Exp 4: SEM	--	3-3 to 3-10	--	Short report: 3-21		
Exp 5: CYOA	2-25	3-3 to 3-22	3-22	3-28	3-30	4-4
Exp 6: Separations	3-7	3-24 to 4-7	4-7	4-14, individual	4-18	--
Throughput						4-19
Poster		First draft: 4-12		Second draft: 4-21		4-25
Final Report, lab notebook, data				May 2 by 5pm, group		