

# Separations

CHEM:5109:0001  
Spring 2018 Syllabus

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## I. Logistics

<b>Instructor</b>	Professor Betsy Stone Chemistry Building W376 (319) 384-1863 <a href="mailto:betsy-stone@uiowa.edu">betsy-stone@uiowa.edu</a>
<b>Class Location/Time</b>	Chemistry Building E264 CB Mondays and Wednesdays 3:30 – 4:45 PM
<b>Office Hours</b>	Mondays and Wednesdays 4:45 – 5:30 PM, Thursdays 4:30-6:00 PM, and by appointment

## II. Course Description and Objectives

<b>Description</b>	Modern techniques for analytical separations will be examined in terms of basic theory, instrumentation, and practical applications. Emphasis is placed on gas and liquid chromatography and electrophoresis. Topics will be explored through a combination of scientific readings, case studies, and independent projects.
<b>Learning Goals and Objectives</b>	<ul style="list-style-type: none"><li>• Develop an understanding of the fundamental principles of analytical separations.</li><li>• Gain practical knowledge of chromatography instrumentation.</li><li>• Understand how to apply extractions and sample clean-up in chemical analysis.</li><li>• Interpret data from separation methods for the purpose of method development, validation, and quantitation.</li><li>• Select and apply the appropriate chromatographic and detection techniques for real-world analyses.</li><li>• Interpret and critically review scientific journal articles</li></ul>

## III. Course Content and Resources

<b>Topics</b>	<b>1. Introduction to Separations</b> <ol style="list-style-type: none"><li>a. Thermodynamic Basis for Separations</li><li>b. Preparative Separations: precipitation and filtration, extraction, distillation</li></ol>
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## 2. Chromatography

- a. General Theory and Background
- b. Gas Chromatography: theory, instrumentation, method development, GC x GC, applications
- c. Liquid Chromatography: theory, stationary phases, mobile phase preparation and optimization, instrumentation, sample preparation, applications
- d. Supercritical Fluid Chromatography: extractions and instrumentation, applications in sample preparation and preparative separations

## 3. Electrophoresis

- a. General Theory and Background
- b. Instrumentation
- c. Applications of Electrophoresis
- d. Lab-on-a-chip

## 4. Detection Techniques (as time allows)

- a. Mass spectrometry, flame ionization, electron capture, conductivity, electrochemical, etc.

### e-Textbook

Miller, James M. *Chromatography: Concepts and Contrasts*. 2<sup>nd</sup> Ed. Oxford: Wiley-Blackwell, 2009.

[Electronic resource](#) available through the University of Iowa Libraries.

### Additional Recommended Readings

Additional readings will be posted on ICON. A good textbook in analytical chemistry or instrumental analysis will provide you with basic knowledge of separation techniques to supplement course readings. The following resources are also recommended as references and are on reserve in the UI Libraries:

#### Books

Giddings, J. Calvin. *Unified Separation Science*. New York: John Wiley & Sons, Inc., 1991.

Peters, D. G.; John M. Hayes, Gary M. Heiftje. *Chemical Separations and Measurements: Theory and Practice of Analytical Chemistry*. Philadelphia: W. B. Saunders Company, 1977.

Robards, Kevin, Paul R. Haddad, and Peter E. Jackson. *Principles and Practice of Modern Chromatographic Methods*. San Deigo, CA: Elsevier Academic Press, 2004.

#### Journals

*The Analyst, Analytical and Bioanalytical Chemistry, Analytical Chemistry, Biomedical Chromatography, Journal of Chromatography A & B, Journal of Separation Science, Journal of High Resolution Chromatography, Trends in Analytical Chemistry*

**Course Website** The course website is posted on ICON (<http://icon.uiowa.edu>). Login with your username and password. Announcements, syllabus, assignments, and readings will be posted here. All assignments and written work must be submitted through the ICON drop box. Please visit this website frequently for announcements and updates that may contain pertinent and/or clarifying information.

**Other Resources** The University of Iowa Libraries (to access e-books and journal holdings); <http://www.lib.uiowa.edu/>

The Writing Center, 110 English Philosophy Building;  
(319) 335-0188; <http://www.uiowa.edu/~writingc>

#### IV. Grading

Grading Scheme			
Problem sets	10%		<i>or 100 points</i>
Sustainability presentation	10%		<i>or 50 points</i>
Article presentation	10%		<i>or 50 points</i>
Exam 1	20%		<i>or 100 points</i>
Exam 2	20%		<i>or 100 points</i>
Final project presentation	10%		<i>or 50 points</i>
Participation	10%		<i>or 50 points</i>

Final grades will be based upon points earned in the above categories. Plus or minus grades will be appended to letter grades. The grade of A+ will be awarded only in extraordinary circumstances.

**Problem sets** will cover course content and will be assigned at regular intervals. These assignments are designed to provide practice in key concepts and calculations and prepare students for exams.

The **sustainability presentation** ties in with the 2018 Theme Semester on sustainability. Students will research and present to the class a recent advancement in preparative separation science that aligns with the principles of green chemistry.

During the semester, each student will be assigned an **article** to present and critically review.

**Exams** will be cumulative, exam dates are noted below. The **final project** consists of an oral presentation on a topic of your choosing in separations.

**Participation** will be assessed through student engagement in

classroom activities and discussions, asking/answering questions, preparedness for class, and pop-quizzes.

<b>Re-grading</b>	Adjustments to grades will only be considered within one week after an assignment or exam is returned. The re-grade request must be accompanied by a written, detailed description of the grading concern. Re-grading will involve re-assessment of the entire assignment and may increase or decrease of the grade.	
<b>Attendance</b>	Attendance at class is mandatory for exams and student presentations. If you have to miss class on one of these days, notify the instructor in advance by completing the <a href="#">Explanatory Statement for Absence</a> form and submitting it electronically through the ICON Dropbox.	
<b>Key Dates</b>	<b>Sustainability presentations</b>	February 19, 21
	<b>Exam 1</b>	March 7
	<b>Exam 2</b>	April 18
	<b>Final project presentations</b>	April 25, 30; May 2
<b>Collaboration</b>	The homework for this course is designed to help you master knowledge related to separations. As such, students may initially discuss their approach to homework assignments with their peers. The work you turn in should be unique, meaning additional collaboration is not allowed. Do not share your work with others or ask others to see their completed assignments because both are considered academic misconduct. If you need help, please meet with the instructor. Students are responsible for understanding this policy; if you have questions, ask for clarification.	

## V. Administrative Details

<b>Chemistry Center</b>	Chemistry Building E225 (319) 335-1341
<b>Department of Chemistry Office</b>	Jim Gloer, Departmental Executive Officer Chemistry Building E331 (319) 335-1350
<b>Administrative Home</b>	The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook at <a href="http://clas.uiowa.edu/students/handbook">http://clas.uiowa.edu/students/handbook</a> .

<b>Electronic Communication</b>	University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences ( <a href="#">Operations Manual, III.15.2</a> , k.11).
<b>Accommodating Disabilities</b>	The University of Iowa is committed to providing an educational experience that is accessible to all students. A student may request academic accommodations for a disability (which includes but is not limited to mental health, attention, learning, vision, and physical or health-related conditions). A student seeking academic accommodations should first register with Student Disability Services and then meet with the course instructor privately in the instructor's office to make particular arrangements. Reasonable accommodations are established through an interactive process between the student, instructor, and SDS. See <a href="https://sds.studentlife.uiowa.edu/">https://sds.studentlife.uiowa.edu/</a> for information.
<b>Non-discrimination in the Classroom</b>	The University of Iowa is committed to making the classroom a respectful and inclusive space for all people irrespective of their gender, sexual, racial, religious or other identities. Toward this goal, students are invited to optionally share their preferred names and pronouns with their instructors and classmates. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories set forth in the University's Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity, <a href="mailto:diversity@uiowa.edu">diversity@uiowa.edu</a> , or visit <a href="http://diversity.uiowa.edu">diversity.uiowa.edu</a> .
<b>Academic Honesty</b>	All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's <a href="#">Code of Academic Honesty</a> : "I pledge to do my own academic work and to excel to the best of my abilities, upholding the <a href="#">IOWA Challenge</a> . I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled ( <a href="#">CLAS Academic Policies Handbook</a> ).
<b>CLAS Final Examination Policies</b>	The final examination schedule for each class is announced by the Registrar generally by the fifth week of classes. Final exams are offered only during the official final examination period. No exams of any kind are allowed during the last week of classes. All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will

be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of a final exam.

**Making a Suggestion or a Complaint**

Students with a suggestion or complaint should first visit with the instructor (and the course supervisor), and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS [Academic Policies Handbook](#)).

**Understanding Sexual Harassment**

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI [Office of the Sexual Misconduct Response Coordinator](#) for assistance, definitions, and the full University policy.

**Reacting Safely to Severe Weather**

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the [Department of Public Safety website](#).