

CHEM531 Analytical Chemistry II
Chromatographic Methods of Analysis
Winter Term 2007

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Monday 7:30-9:00 pm, Stratton 219
Wednesday 6:00-7:30 pm, LeBow 134
Office Hours: Monday 6:00-7:30 pm

Required Textbook:

J.M. Miller, Chromatography: Concepts & Contrasts, 2nd ed., New York: John Wiley & Sons, Inc., 2005.

Course Grading:

Problem sets (one or more)	10%
Mid-term exam	30%
Final exam	35%
Oral presentation (see below for details)	25%

Note: The new +/- grading system is in play.

Proposed Schedule:

Mid-term exam (week of 2/5/07, may be a take-home exam)
Final exam (finals week, in-class exam)

Additional Texts:

J. Calvin Giddings, Unified Separation Science, New York: John Wiley & Sons, Inc., 1991.
B.L. Karger, L.R. Snyder, C. Horvath, An Introduction to Separation Science, New York: John Wiley & Sons, Inc., 1973.
C.F. Poole, S.K. Poole, Chromatography Today, New York: Elsevier Science Publishers, 1991.

Journals (recent research):

Electrophoresis
Journal of Chromatography A/B
Journal of Separation Science
Advances in Chromatography
Biomedical Chromatography
Chromatographia (rapid communication)
Journal of Chromatographic Science

List of Topics:

Impact of Industrial and Governmental Regulatory Practices on Analytical Chromatography	text chapter 1
Introduction to Chromatography	text chapter 2
historical perspective	
types of separations	
theory of extraction	
terminology	
Band Broadening & Kinetics	text chapter 3
plate theory of chromatography	
random-walk theory of chromatography	
peak broadening mechanisms	
resolution and column properties	
Physical Forces and Interactions	text chapter 4
Optimization and the Achievement of Separation	text chapter 5
Chromatographic Theory (J.C. Giddings text)	
Introduction	
Equilibrium: Separative Displacement	
Separative Transport	
Flow Transport and Viscous Phenomena	
Zone Formation and Resolution	
Sample Preparation	text chapter 14
Liquid-liquid extraction	
Solid phase extraction/solid phase microextraction	
Supercritical fluid extraction	
Survey of Chromatographic Methods	
Comparisons Between Chromatographic Modes	text chapter 6
Gas Chromatography	text chapter 7
introduction (gas/liquid, gas/solid techniques)	
column properties	
instrumentation	
gas supplies	
injection systems	
detectors	
High Performance Liquid Chromatography	text chapter 8
introduction	
column properties	
instrumentation	
gas supplies	
injection systems	
detectors	
types of separations	
chiral separations	
ion chromatography	

ion-pairing chromatography	
micellular chromatography	
Plane Surface Methods (paper and thin-layer chromatography)	text chapter 11
Capillary Electrophoresis and Capillary Electrochromatography	text chapter 13
Special Applications	text chapter 15
Multidimensional Chromatography	
Chiral Separations	
Size Exclusion (Gel Permeation) Chromatography	
Affinity Chromatography	
Field Flow Fractionation Techniques	
Flow-Injection Analysis	

Derivatization Techniques for Chromatography

Oral Presentation:

Each pair of students is responsible for preparing a 25 minute talk (plus 5 minutes for questions) on a chromatographic method related subject for presentation to the class during the last two weeks of the course. Each group should notify me of their chosen topic (first-come, first-served, no duplication) *as soon as possible*. The grading will be based both on the content of material (e.g. appropriate level of coverage) and presentation (clarity and organization). You **must** prepare an annotated bibliography of the references you used for your presentation; as your presentation **must** be in electronic format (i.e., a Powerpoint file) this will also be made available to all students in the class through WebCT. The following is a brief list of suggested topics:

Example Oral Report Topics

counter-current chromatography
two-dimensional electrophoresis
purification of biological materials using chromatography
chiral stationary phases
supercritical fluid extraction
synthetic polymer analysis using gel permeation chromatography
affinity chromatography
solid phase extraction (SPE)
ion-pairing chromatography
micellular chromatography
capillary electrophoresis
ion chromatography
field flow fractionation techniques
flow-injection analysis
random-walk theory of chromatography
Monte Carlo simulations of chromatographic separations
solid-phase microextraction (SPME)
spectroscopic investigations of chromatographic interactions
pyrolysis gas chromatography
high-performance thin-layer chromatography
cryogenic pre-concentration techniques
molecular property measurements via chromatography

If you select one of the hyphenated techniques (GC/MS, etc.) listed below, your presentation must emphasize the special problems involved with and the techniques used to interface the two pieces of instrumentation (i.e., it **should not** be a talk on the mass spectrometry results):

- gas chromatography/Fourier-transform infrared absorption
- gas chromatography/mass spectrometry
- liquid chromatography/mass spectrometry
- supercritical fluid chromatography/mass spectrometry

Note that any other chromatographic technique (or methodology) that has been covered in a review-type article (such as an A-page or Feature Article in the journal *Analytical Chemistry*) would be appropriate for this presentation.

Recorded Lectures:

The lectures for this class will be recorded; the screencasts will be made available on the lecture archive page available through the course homepage on WebCT. Every effort will be made to have the screencasts posted within 48 hours of the class. In some cases additional material will be assigned as recorded lectures only. You are responsible for the material presented in those lectures as well.

WebCT:

We will be using WebCT (Drexel's on-line course tool package) to enhance communication in CHEM531. The instructions below tell you how to log on and begin using WebCT.

- 1) Login through DrexelOne at <http://one.drexel.edu>.
- 2) Enter your Drexel domain ID and password, click on **Login**.
- 3) Click on the **Student Services** Tab.
- 4) Click on the **My Courses** link.

or

- 1) Enter the Drexel WebCT Vista website directly at <http://vle.dcollege.net/>.
- 2) Click on the hyperlink for Drexel University.
- 3) Click on the **Log In** button.
- 4) Enter your Drexel domain ID and password, click on **OK**.

If you enter these correctly you will now be at your MyWebCT Home Page in the WebCT area. Select **CHEM531** from the list of courses in the center pane of the screen. You will now be on the course homepage. Select the **Bulletins** icon to read posted messages, the **Calendar** icon for the course schedule, etc. All of your problem sets and take-home exams will be posted as assignments on the homepage.