

CHEMISTRY 527
SYLLABUS, Fall 2007

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TEXT: *Experimental Organic Chemistry* by Daniel R. Palleros
John Wiley & Sons, Inc., 2000

OTHER: Experimental procedures from the Journal of Chemical Education and other special supplements from the Instructors as needed.

INTRODUCTION: This course has been designed to provide a realistic experience that highlights the integral nature of chemical synthesis and analytical characterization. With this purpose in mind, the lecture component of the course will cover principles, theoretical and experimental concepts on a variety of contemporary approaches to chemical synthesis and analysis. In the laboratory, a selected set of applications will be demonstrated. The specific topics are identified below.

Section A. Spectroscopy and its Applications (approx. 9 weeks)

1. *Two and 1/2 weeks:* Text unit 33: Introduction to ^1H NMR spectroscopy. Lab experiments: synthesis of a 7-oxanorbornene derivatives and analysis of ^1H spectral data on the products.
2. *Two and 1/2 weeks:* Text unit 33: Introduction to ^{13}C NMR spectroscopy. Lab experiments: data acquisition and processing of ^{13}C and DEPT data and analysis of product from previous week.
3. *Two weeks:* text unit 31: Principles of infrared spectroscopy; introduction to analysis by the use of group frequencies. Lab experiments: introduction to data acquisition and processing; review of sampling methods and identification of an unknown; preparation of peracetylated glucose and mannose and analysis of the products.
4. *One week:* Raman scattering spectroscopy. Analysis of IR and Raman spectral data.
5. *One week:* Text unit 23B: Introduction to ultraviolet-visible spectroscopy and its applications in the analysis of organic compounds. Quantitative analysis of a mixture dyes.

Section B: Chromatography and its Applications (approx. 4 weeks)

1. *One week:* Text unit 8: Introduction to liquid chromatography: thin layer chromatography; column chromatography. Lab experiment: separations by TLC and column chromatography.

2. *One and 1/2 weeks:* Text unit 7: Principles of gas chromatography. Principles of phase transfer catalysis. Lab experiments: separation and analysis of a mixture; phase transfer catalyzed oxidation and analysis of the product mixture.
3. *One and 1/2 weeks:* Text unit 10: Principles of high performance liquid chromatography. Introduction to peptide synthesis and analysis. Lab experiments: synthesis of a dipeptide and analysis of product mixtures.

EXAMINATIONS AND REPORTS:

There will be examinations at the end of sections A (300 pts) and B (200 pts). Also, there will be laboratory reports and out-of-class assignments worth 500 points (total) and due within **one week** of completion of each experiment. The maximum number of points for the semester is 1000.

Tentative exam dates: #1 (based on NMR, IR and Raman) October 22 and 24, 2007

#2 (based on UV-vis spectroscopy and Section B) December 7, 2007

GRADING:

Your grade will be established as a percentage of the 1000 points that you have accumulated; the grade scale (as percentages) will be as follows:

90 – 100 = A

80 – 89 = B

70 – 79 = C

60 – 69 = D

<60 = F

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Tentative Schedule for Fall 2007

Week #1	NMR: principles and implementation	M (08/20/07) MCY
	¹ H NMR: interpretation of spectral data	W (08/22/07) CVR
	Lab: Synthesis of a 7-exo norbornene derivative	
Week #2	¹ H NMR: interpretation of spectral data	M (08/27/07) CVR
	NMR: instrumentation, FIDs, FT	W (08/29/07) MCY
	Lab: ¹ H NMR/Diels Alder (DA) adduct, FID generation	
Week #3	No lecture HOLIDAY	M (09/03/07)
	¹³ C NMR: interpretation of spectral data	W (09/05/07) CVR
	Lab: Methanolysis of DA adduct	
Week #4	NMR: relaxation mechanisms	M (09/10/07) MCY
	¹³ C NMR and DEPT	W (09/12/07) CVR
	Lab: ¹ H, ¹³ C NMR & DEPT analysis of DA product	
Week #5	Integrating NMR Spectral Data	M (09/17/07) CVR
	FTIR: principles and implementation	W (09/19/07) MCY
	Lab: Introduction to peracetylation of glucose and mannose	
Week #6	FTIR: instrumentation	M (09/24/07) MCY
	FTIR spectral interpretation	W (09/26/07) CVR
	Lab: Peracetylation of glucose and mannose (cont.)	
Week #7	FTIR spectral interpretation	M (10/01/07) CVR
	Raman Spectroscopy: principles and instrumentation	W (10/03/07) MCY
	Lab: NMR and IR spectral analysis of anomers	
Week #8	Fall Break; No Lecture	M (10/08/07)
	Conventional vs. Resonance Raman	W (10/10/07) MCY
	Lab: Analysis and Interpretation of Raman and IR data for UNKs and UV-vis analysis of binary mixtures	

Week #9	UV-Vis Molecular spectroscopy UV-vis applied to organic analysis	M (10/15/07) MCY W (10/17/07) CVR
	Lab: To be designed	
Week #10	EXAM #1: Org. Coverage: weeks 1 –9	M (10/22/07) CVR
	EXAM #1 Analyt: Coverage: weeks 1 –9	W (10/24/07)
	No Lab	
Week #11	TLC/Column Chromatography Phase transfer catalysis	M (10/29/07) MCY W (10/31/07) CVR
	Lab: chromatographic separation of anomers	
Week # 12	Practical Applications in Organic Analysis Gas Chromatography: principles	M (11/05/07) CVR W (11/07/07) MCY
	Lab: GC Analysis of oxidation products	
Week #13	Gas Chromatography: instrumentation HPLC: principles	M (11/12/07) MCY W (11/14/07) MCY
	Lab: GC Analysis of products	
Week #14	HPLC: instrumentation Thanksgiving Holiday	M (11/19/07) MCY W (11/21/07)
	Lab: peptide derivative preparation	
Week #15	Peptide sequence determination HPLC: instrumentation	M (11/26/07) CVR W (11/28/07) MCY
	Lab: HPLC analysis of peptide derivative residues Check out and evaluation	
	Last lecture: evaluations and review	M (12/03/07)

Final Exam (both Analytical and Organic): Friday, December 7th, 8:00 – 10: 30 a.m.