

SYLLABUS

CHEM 224 – Organic Chemistry B – 2nd semester (revived off-semester trailer course)
Fall 2009 - LOYOLA UNIVERSITY CHICAGO (LUC)

Lecture: #9322 **Section:** 001 **M+W+F** **10:25 a.m. – 11:15 a.m.** Flanner Auditorium-133
Discussion: #9323 **Section:** 002 **Tuesday** **1:00 p.m. – 2:00 p.m.** **FH-105**

Sr. Lecturer: Dr. C. Szpunar
 Office: Flanner Hall 213 Contact: 773-508-3128, cszpuna@luc.edu
 Emergency Message: Chemistry Dept. Office, 773-508-3100, fax: 773-508-3086
 Student Office Hours: **Mon and Wed and Fri:** noon - 1:30 p.m. + by prior appt

Required: Organic Chemistry, Wade, 7th ed., Prentice Hall, 2009 (ISBN xxxxxxxx)
 or Wade, 6th ed., Prentice Hall, 2003 (ISBN 0-13-147871-0)

Suggested / Recommended Materials:

1. Study Guide and Solutions Manual, Wade & Simek, 7th ed. (ISBN xxxx)
 or 6th ed. (ISBN 0-13-147882-6)
2. Molecular modeling kit, Darling, Prentice-Hall, Freeman (Maruzen), Proteus, or equivalent
3. Spiral or bound notebook for homework problems

Optional Materials:

1. Barron's Orgo Cards: Organic Chemistry Review, Wang, Razani, Lee, Wu, and Berkowitz (ISBN 0-7641-7503-3).
2. Organic Chemistry: A Short Course, Hart, Craine, Hart, and Hadad (12th edition, 2007), w/CD-ROM, Houghton Mifflin (ISBN-10: 0-618-59073-0, ISBN-13: 978-0-618-59073-5) (*Pls see instructor before purchasing, only for students who may require an alternative study approach.*)

Grading (approx weight below) with grade guidelines: > 90% A; 75-90% B; 55-75% C; *grading may be curved*

EXAMS – 3 – dates scheduled and announced (subject to change, although unlikely)

!!! NO MAKE UPS !!! NO EARLY EXAMS !!!

40 %

- UNEXCUSED ABSENCES merit a zero score.
- EXCUSED ABSENCES are handled on a case-by-case basis; grade weighting may be adjusted, depending on the circumstance(s); however, an excused absence **MUST BE CORROBORATED and DOCUMENTED**, e.g., accompanied by a note from the doctor, dentist, hospital rep, or funeral director; by a court summons, plane ticket stub, hospital release form, obit, or other.

QUIZZES – TBD – unannounced (during lecture or discussion or as take-home, **no make-ups**)

20 %

HOMEWORK - assigned per topic, see Suggested Homework Assignment, below

3.5%

FINAL EXAM – date scheduled announced (and scheduled by CAS)

36.5%

Course Objective: To guide, encourage, and foster the learning and understanding of Organic Chemistry – nomenclature, structures, properties, reactions, mechanisms, and syntheses – by the individual student, helping him/her to connect, extrapolate, integrate, and apply the many different aspects learned.

Student Outcomes: The successful student will learn how to ...

1. identify the various classes of organic compounds, their methods of preparation, and typical reactions.
2. name and draw specific organic compounds.
3. postulate a *logical* reaction mechanism for simple organic reactions.
4. discriminate amongst relative stabilities of reaction intermediates.
5. plan and write out multi-step syntheses using known functional group transformations.
6. prepare for basic purification/separation techniques of organic compounds required in the laboratory.
7. analyze and interpret data from various instruments used in separating and identifying organic compounds: IR, NMR, and UV-vis spectrophotometers and mass spectrograph.

Lecture and Discussion – Attendance and Attention: Important and required. Feel free to bring your books and modeling kit to class. Better yet, use them. Prepare for lecture by prior scanning of new material. Come prepared for discussion, ready to ask questions on assigned homework or yet unassimilated lecture material.

Phones and Pagers: Please be courteous and respectful of others. Silent mode during lecture and discussion. *Not allowed in sight or within hearing during exams, subject to confiscation.* NO phone conversations in lecture hall or in discussion class – before class, during class, after class – AT ANY TIME!

Academic Honesty: Essential, expected, and enforced. Dishonesty dictates consequences which may include: (1) notification of Chemistry Department Chair, student's Department Chair, and CAS Dean, (2) documentation in the student's official university record, and (3) dismissal from the university. Immediate consequences will include a **ZERO** on any item in question (quiz or exam). Please refer to the LUC Undergraduate Handbook on policies or the CAS website: http://www.luc.edu/cas/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf.

Study Strategies and Suggestions: One may approach the study of Organic Chemistry in a manner similar to tackling a new foreign language. Its study will provide a basis to understanding future material – building constantly, incessantly, and relentlessly on the structural and mechanistic information presented previously. Over two semesters, the course will cover functional groups, aliphatic and aromatic compounds, bonding, nomenclature, stereochemistry, conformational analysis, reaction mechanisms, multi-step syntheses, and spectroscopy. Because the course is cumulative and builds heavily on prior material, the best plan is to study Organic Chemistry regularly, every day, similar to practicing the piano. Collaboration on homework problems is encouraged, especially in a timely fashion. Experience dictates that positive outcomes (for exam and course grades) are directly proportional to working and understanding the assigned problems on a regular basis, i.e., applying the concepts learned to non-generic compounds.

Typically, Organic Chemistry is not efficiently self-taught. Overnight cramming will probably not produce success. The student should quickly read the chapter/segment to be covered BEFORE lecture to improve lecture comprehension. After lecture, careful detailed re-reading of the chapter/segment and focused working of the assigned problems are appropriate, necessary, and expected. In addition to student's participation in lecture, discussion, reading, and homework, joining and contributing to a study group is encouraged.

If anticipating a passing grade of C, the minimal time per week devoted to Organic Chemistry is estimated at 4 hr for lecture/discussion, 3-6 hr for reading, and 3-6 hr for homework.

Suggested Homework Assignment (Wade 7th edition):

Review: Chap 12: 2-7, 11-12, 14-17, 23, 25
 Chap 13: 2-11, 14-15, 22-25, 32-36, 38-44
 Chap 15: 1, 4-18, 22-27, 30
 Chap 16: 3-4, 7-8, 9 (a,b), 12-29, 32, 38-39, 45, 49
 Chap 17: 1-27, 30, 31 (a,b,d), 32, 38, 40-52
 Chap 18: 1-4, 6-13, 16-31, 34-40, 43-44, 47-51
 Chap 19: 1-21, 25-32, 34-44, 47, 56, 58
 Chap 20: 1-40, 45, 50
 Chap 21: 1-39, 43-54, 62
 Chap 22: 1-47, 59-65, 67-69
 Chap 23: 1-14, 16-18, 21-22, 24-26, 28-31, 32 (a), 33-36, 40-41 (a,b), 52-56, 63
 Chap 24: 3-6, 9-11, 20, 32-33
 Chap 25: 1, 5, 9, 11-15, 30
 Chap 26: FYI: 21-29

(for Wade 6th edition):

Review : Chap 12: 2-12, 14-19, 23, 25
 Chap 13: 2-36, 38-45
 Chap 15: 1, 4-18, 22-27, 30
 Chap 16: 3-4, 7-8, 9 (a,b), 12-29, 32, 38-39, 45
 Chap 17: 1-2, 4-22, 24-27, 30-32, 38, 40-52
 Chap 18: 1-4, 6-12, 16-31, 34-40, 43-44, 47, 49, 51
 Chap 19: 1-21, 25-32, 34-42, 44, 47, 56, 58

Chap 20: 1-33, 35-40, 45, 47, 50
Chap 21: 1-39, 43-48, 50-54, 66
Chap 22 : 1-47, 59-65, 67-69
Chap 23: 1-14, 16-17, 21-22, 24-26, 28-31, 32 (a), 33-36, 40, 41 (a,b), 52-55, 63
Chap 24: 3-6, 20, 32, 33
Chap 25: 1, 4, 8-9, 11-15, 32
Chap 26: FYI, 21-29

Optional BONUS Report

CHEM 224, Fall 2009, Dr. Szpunar

*****BE SURE to include** on the cover sheet or top right of pg #1:

- a) your name
- b) the date
- c) CHEM 224 – Fall – MWF
- d) lecturer's name

(max of 3%):

Optional Bonus Report is intended for enrichment; points therefrom are only considered as a grade component IF student's interim grade is a C or better (i.e., >55% approx weighting).

Visit the *International Museum of Surgical Science* and write a 1-2 pp. report (of 12-pt type, 1-in margins, double-spaced, and stapled) highlighting at least 2 of its exhibits. Attach a pamphlet from the museum on one of its exhibits.

You may wish to check to see if the # 151 Sheridan Bus (or equivalent) is more efficient than the CTA el; the bus may drop you closer to the museum, located just south of North Avenue Beach near the Polish Consulate on inner Lake Shore Drive.

1524 N. Lake Shore Drive
Chicago, IL 60610 USA
312.642.6502, fax 312.642.9516, info@imss.org
HOURS: May - September: Tuesday through Sunday 10 am – 4 pm
October - April: Tuesday through Saturday 10 am – 4 pm
ADMISSION: Adults \$6, Students & Seniors \$3
(Be sure to check the website for the current fee and free day!)

***** due on or before Wednesday, November 4, noon *****

Homework Package:

***** due Thursday, November 12, 2009 by 12 noon *****

Hand in at least 10 completed problems (or parts of multiple problems) per chapter, Chapters 15–21. (Underlined problems are particularly insightful or anticipatory.) If not using a notebook, include your name and the date worked on **each** page. Mark the chapter and problem number for full credit. For ease in grading, staple package in chapter order *****or*** flag chapters in homework notebook** (which will be returned to the student), as applicable.

Topics: to be covered this semester:

12/13. Spectroscopy: Methods of Structure Determination (Review): Electromagnetic spectrum, molecular vibrations, infrared spectroscopy, characteristic IR absorptions, IR spectra interpretation, mass spectrometry (MS), terminology associated with MS, nuclear spin, magnetic shielding, NMR spectrometer, chemical shift, chemical nonequivalence, peak integration, spin-spin splitting, time dependence, interpreting NMR spectra, combined spectroscopy problems.

15. Dienes, Conjugated Systems, UV Spectroscopy: Molecular orbital theory, 1,3-butadienes, electrophilic addition (1,2 and 1,4), NBS, Diels Alder rxn.

16/17. Aromatic Compounds: Benzene, Kekule structure, resonance, annulenes, MO theory, aromaticity, Huckel's Rule, heterocyclic aromatics, electrophilic aromatic substitution, directing effects on electrophilic aromatic substitution, Friedel-Crafts alkylation and acylation, nucleophilic aromatic substitution, side-chain reactions of benzene derivatives, reactions of phenols.

18. Aldehydes and Ketones: Structure of the carbonyl group; nomenclature, physical properties, and spectroscopic properties of aldehydes and ketones; syntheses of aldehydes and ketones; addition reactions; Wittig reaction; condensation reactions; acetals; oxidation and reduction.

19. Amines: Nomenclature, structure, physical properties, basicity, salts of amines, phase transfer catalysis, spectroscopic properties, reactions of amines, sulfonamides, Hofmann elimination, Cope Elimination, arenediazonium salts, synthesis of amines.

20. Carboxylic Acids: Structure and nomenclature, physical properties, acidity, salts of carboxylic acids, spectroscopy, synthesis of carboxylic acids, nucleophilic acyl substitution, Fischer esterification, synthesis and use of acid chlorides, diazomethane, condensations of carboxylic acids, reduction, alkylation of carboxylic acids.

21. Carboxylic Acid Derivatives: Structure and nomenclature, physical properties, and spectroscopic properties of carboxylic acid derivatives, nucleophilic acyl substitution, hydrolysis of acid derivatives, reduction of acid derivatives, organometallic reactions, thioesters, carbonic acid derivatives.

22. Enols and Enolates: Enols, enolates, alpha halogenation, alkylation of enolates, formation and alkylation enamines, aldol condensation, dehydration of aldol products, crossed aldol condensation, aldol cyclizations, Claisen condensation, Dieckmann condensation, crossed Claisen condensation, β -dicarbonyl compounds, Malonic ester synthesis, acetoacetic ester synthesis, conjugate addition, Michael reaction, Robinson annulation.

23. Carbohydrates: Classification of carbohydrates, monosaccharides, erythro and threo diastereomers, epimers, nomenclature, cyclic structures of monosaccharides, anomers, mutarotation, reactions of monosaccharides, oxidation and reduction of monosaccharides, non-reducing sugars, formation of glycosides, ether and ester formation, osazone formation, Ruff degradation, Kiliani-Fischer synthesis, Fischer's proof of configuration, determination of ring size, periodic acid cleavage, disaccharides, polysaccharides.

24. Amino Acids and Peptides: Structure and stereochemistry of the α -amino acids, synthesis of amino acids, resolution, structure and nomenclature of peptides and proteins, peptide structure determination, peptide synthesis.

25. Lipids: Miscellaneous category, classification by solubility: waxes, triglycerides, soaps and detergents, phospholipids, steroids, prostaglandins, terpenes.

Lecture Outline (tentative, subject to change)

<u>Week</u>	<u>Date</u>	<u>Chapter-Lec</u>	<u>Topic</u>	<u>***EVENT***</u>
1	Aug 24	*12 + 13*	Review – IR, MS, NMR	
	26	15-1	Conjugated Systems, UV Spectroscopy	
	28	15-2		
2	Aug 31	15-3		
	Sept 2	15-4		
	4	16-1	Aromatic Compounds	
3	Sept 7	***	***** MONDAY *****	LABOR DAY – HOLIDAY ***
	9	16-2		
	11	16-3		
4	Sept 14	17-1	Aromatic Compounds - Reactions	
	16	17-2		
	18	17-3		
5	Sept 21	***	***** MONDAY *****	EXAM I (Chapters 12-13, 15-17)
	23	18-1	Ketones and Aldehydes	
	25	18-2		
6	Sept 28	18-3		
	30	18-4		
	Oct 2	18-5		
7	Oct 5	***	***** MONDAY *****	MIDTERM BREAK ***
	7	19-1	Amines	
	9	19-2		
8	Oct 12	19-3		
	14	19-4		
	16	19-5		
9	Oct 19	20-1	Carboxylic Acids	
	21	20-2		
	23	20-3		
10	Oct 26	***	***** MONDAY *****	EXAM II (Chapters 18-19)
	28	21-1	Carboxylic Acid Derivatives	
	30	21-2	***** (and last day to withdraw with a W) *****	
11	Nov 2	21-3		
	4	22-1	Enolates, Alpha Substn, and Aldol Condensations of Carbonyls - (*Bonus due*)	
	6	22-2		
12	Nov 9	22-3		
	11	22-4		
	12	***	***** THURSDAY *****	HW assignment due for grade
	13	23-1	Carbohydrates and Nucleic Acids	
13	Nov 16	***	***** MONDAY *****	EXAM III (Chapters 20-22)
	18	23-2		
	20	23-3		
14	Nov 23	23-4		
	25	***	***** WEDNESDAY *****	THANKSGIVING DAY – HOLIDAY ***
	27	***	***** FRIDAY *****	THANKSGIVING DAY – HOLIDAY ***
15	Nov 30	24-1	Amino Acids, Peptides, and Proteins	
	Dec 2	24-2		
	4	25/26	Lipids / Intro to Polymers	
16	Dec 7 Mon	*****	Cumulative FINAL EXAM, 9:00 a.m. – 11:00 am., Flanner Auditorium-133	