

SYLLABUS

CHEM 224 – ACCELERATED - Organic Chemistry B – 2nd semester
Summer 2012 - LOYOLA UNIVERSITY CHICAGO

Lecture/Discussion: #1350 / 1351 Sections: 003 / 004 **M+W+F: 8:30 a.m. – 11:20 a.m.** Cuneo 002

Dr. C. Szpunar

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Emergency Message - Chemistry Dept. Office Admin: 773-508-3100, fax: 773-508-3086 (Denise Hall, Carol Grimm)

Student Office Hours (no appt needed): M and W: after class, 11:45 – 1:15, and *** by **prior appt** ***

Required:

1. Organic Chemistry, Wade, 7th ed. (navy blue), Prentice Hall, 2009 (ISBN 9780321592316)
or 6th ed. (black), Prentice Hall, 2003 (ISBN 0-13-147871-0) *or* 5th ed. (white)
2. Study Guide and Solutions Manual, Wade & Simek, 7th ed. (ISBN 9780321598714)
or 6th ed. (ISBN 0-13-147882-6) *or* 5th ed.

Suggested / Recommended Materials:

1. Molecular modeling kit, Darling, Prentice-Hall, Freeman (Maruzen), Proteus, or equivalent
2. Spiral or bound notebook for homework problems

Optional Materials (found helpful by some students):

1. Organic Chemistry as a Second Language, II, Klein (2006), Wiley (ISBN 978-0-471-73808-4)
2. Barron's Orgo Cards: Organic Chemistry Review, Wang, Razani, Lee, Wu, and Berkowitz (ISBN 0-7641-7503-3)

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

MID-TERM EXAM – 1 – date scheduled and announced (subject to change, although unlikely)

!!! NO MAKE UPS !!!

25%

- 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, as appropriate. With proper documentation, religious observance, official representation of the university, or personal emergency may constitute an Excused Absence.

QUIZZES – 4 – dates announced (subject to change, although unlikely) **!!! NO MAKE UPS !!!** 30%

FINAL EXAM

45%

Please note that because this course, Organic Chemistry, is cumulative, comprehensive, and improvement-based and because the final-exam grade is deemed a culminating measure of a student's progress, any student meriting an F on the final exam will achieve a recorded course grade no higher than D, despite total points; a final-exam score of D will merit a course grade no higher than C, despite total points; and a final-exam score of C will merit a course grade no higher than B, despite student's standing otherwise (i.e., despite total points.)

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: If successful, the 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.

- discriminate amongst relative stabilities of reaction intermediates.
- plan and write out multi-step syntheses using known functional group transformations.
- prepare for basic purification/separation techniques of organic compounds required in the laboratory.
- 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.

Cell Phones: 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! NO texting; if you must, take it outside.

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 in the summer devoted to Organic Chemistry is estimated at 9 hr for lecture/discussion, 6-12 hr for reading, and 6-12 hr for homework.

Suggested Homework Assignment (Wade 7th edition):

- 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

Wade 6th edition

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: 21-29

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, but unlikely due to time constraints)

<u>Lecture</u>	<u>Date</u>	<u>Chapters</u>	<u>Topic</u>	<u>*** EVENT ***</u>
1	M-July 1	12/13	Review – IR, MS, NMR	
2	W-July 3 Th- July 4	12/13/15	... / Conjugated Systems, UV Spectroscopy	
3	F-July 5	15	... ***** Independence Day Holiday – NO CLASS ***** ***** Quiz 1 (Chapters 12/13)	
4	M-July 8	16	Aromatic Compounds	
5	W-July 10	16	...	
6	F-July 12	17	Aromatic Compounds - Reactions ***** Quiz 2 (Chapters 15-17)	
7	M-July 15	17	...	
8	W-July 17	17/18	... / Aldehydes and Ketones	
9	F-July 19	18	... ***** MID-TERM EXAM (Chapters 12-13, 15-18 partial)	
10	M-July 22	18	...	
11	W-July 24	19	Amines	
12	F-July 26	19	... ***** Quiz 3 (Chapters 18-19)	
13	M-July 29	19/20	... / Carboxylic Acids	
14	W-July 31	20	...	
15	F-Aug 2	21	Carboxylic Acid Derivatives ***** Quiz 4 (Chapters 20-21) ***** <i>last day to withdraw with W, not WF</i> *****	
16	M-Aug 5	22	Condensations, Alpha Substitutions, Enolates	
17	W-Aug 7	23/24	Carbohydrates / Amino Acids and Peptides	
18	F-Aug 9	25	Lipids / Q/A ***** Cumulative FINAL EXAM (focus: Chapters 18-23)	

Daily Schedule (tentative, approximate, flexible, may adjust order):

<u>Regular Day</u>	<u>Quiz Day</u>	<u>Exam Day</u>
08:30 – 09:00 am Q/A, admin	08:30 – 09:00 am Q/A	08:30 – 09:00 Q/A
09:00 – 10:00 lecture – 1	09:00 – 10:00 lecture - 1	09:00 – 10:20 lecture
10:00 – 10:10 ***break***	10:00 – 10:10 ***break***	10:20 – 10:30 ***break***
10:10 – 10:30 discussion as time/topic permit	10:10 – 11:00 lecture – 2	10:30 – 11:20 EXAM *****
10:30 – 11:20 lecture - 2	11:00 – 11:20 quiz	08:30 – 09:10 Q/A
		09:10 – 09:20 ***break***
		09:20 – 11:20 FINAL