

SYLLABUS – OFF-SEMESTER CHEM 224 – Organic Chemistry B – 2nd Semester – MWF Lecture
Fall 2016 - LOYOLA UNIVERSITY CHICAGO (LUC)

Lecture: #6336 **Section:** 011 **Mon+Wed+Fri** **2:45 – 3:35 pm** *****Flanner Auditorium**

Discussion: #6337 **Section:** 012 Wednesday 11:30 am-12:20 pm Flanner 007
#6338 **Section:** 013 12:35 pm - 1:25 pm
~~#6339 **Section:** 014 1:40 pm - 2:30 pm~~

Senior Lecturer: Dr. C. Szpunar

Office: Flanner Hall **200B**

Contact: best in person, 773-508-3128, cszpuna@luc.edu

Emergency Message via Chemistry Dept. Office, 773-508-3100, fax: 773-508-3086

Office Hours: **Mon** and **Fri:** 12:00 noon-2 pm, **Tues:** 10 am-noon ***** and as arranged **prior**

N.B.: Answer keys will be posted in the glass case outside Flanner 200B. No photographing pls!

Required:

1. Organic Chemistry, Wade 8th ed. (**red**), Prentice Hall, 2013 (ISBN 978-0-321-76841-4) *or* Wade, 7th ed. (**navy blue**), Prentice Hall, 2010 (ISBN 978-0-321-59231-6) *or* 6th ed. (**black**), Prentice Hall, 2003 (ISBN 0-13-147871-0) *or* 5th ed. (white) *or* equivalent
*****NO ACCESS CODE NEEDED, NOR DESIRED, NOR SUGGESTED*****
2. Study Guide and Solutions Manual, Wade & Simek, 8th ed. (ISBN 978-0-321-77389-0) *or* 7th ed. (ISBN 978-0-321-59871-4) *or* 6th ed. (ISBN 0-13-147882-6) *or* 5th ed., as appropriate to accompany text

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, but hold off initially – do not purchase immediately):

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)
3. 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) (Please see lecturer **BEFORE** purchasing - only for students who may require an alternative-study approach.)

Grading (weighting below) with approximate curved grade guidelines: > 90% A; 75-90% B; 55-75% C

EXAMS – 3 – dates scheduled, announced (subject to change, although unlikely) **NO MAKE UPS** **45%**

- 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, obituary, or other. **With proper documentation**, religious observance, representing the university, or personal emergency constitutes an Excused Absence.

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

QUIZZES – TBD – **unannounced** (during lecture or discussion or as take-home, **NO MAKE UPS**) **20%**

FINAL EXAM – date scheduled and announced (scheduled by CAS) **35%**

*** Please note that because this course, *Organic Chemistry, is cumulative, comprehensive, and improvement-based*, and because the final exam is deemed a culminating measure of a student's progress, any student meriting an F on the final exam may achieve a recorded course grade no higher than D, despite total points; a final-exam score of D may merit a course grade no higher than C, despite total points; and a final-exam score of C may 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, mechanisms, syntheses, and spectroscopy – 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.
4. discriminate amongst relative stabilities of reaction intermediates.
5. plan and write out multi-step syntheses using known reagents / conditions to transform functional groups.
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; be ready to ask questions on assigned homework or yet-unassimilated lecture material.

Cell Phones: NONE. 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 – before class, during class, after class – AT ANY TIME! If you must talk or text, take it outside!!!

Photography: NONE. No photography of posted quiz or exam keys. No photography of discussion or lecture blackboard or whiteboard content.

Recording: NONE. No recording of lectures.

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/academics/catalog/undergrad/reg_academicintegrity.shtml.

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 and, hopefully, acquired by the student. Over two semesters, the course will cover: bonding, functional groups, families of aliphatic and aromatic compounds, nomenclature, structures, stereochemistry, reaction mechanisms, multi-step syntheses, and spectroscopic techniques. 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 situations.

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, essential, and expected. In addition to student's participation in lecture, discussion, reading, and homework, joining and contributing to a study group is strongly encouraged.

If anticipating a passing grade of C, the minimal time per week devoted to Organic Chemistry is estimated at 4 hr for lecture and discussion, 4-10 hr for reading, and 4-10 hr for homework.

Suggested Homework Assignment (for Wade's [red] 8th edition):

Chap 15: 1, 4-18, 22-27, 30, 33
Chap 16: 3-4, 7-8, 9 (a,b), 12-29, 31-32, 38-39, 45
Chap 17: 1-29, 33-35, 37-40, 42-44, 46-52, 54
Chap 18: 1-4, 6-11, 15-30, 33-39, 43-44, 46-51
Chap 19: 1-21, 25-33, 34-37, 39, 42, 44, 47, 51, 53
Chap 20: 1-21, 23-33, 35-40, 45
Chap 21: 1-39, 42-54, 62, 64-65
Chap 22: 1-47
Chap 23: 1-14, 16-17, 21-22, 24-26, 28-31, 32 (a), 33-36, 40, 41 (a,b), 52-53, 55, 58
Chap 24: 1-3, 20, 33
Chap 25: 1-5, 9-13, 15, 30
Chap 26: 17 and as warranted

Suggested Homework Assignment (Wade 7th edition, [navy blue]):

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

Suggested Homework Assignment (Wade 6th edition, [black])

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 (subject to change) – **Fall 2016**

<u>Week</u>	<u>Date</u>	<u>Chap-Lecture</u>	<u>Topic</u>	***EVENT***
1	Aug 29	12	Review – Spectroscopy – IR, MS	
	31	13	Review – Spectroscopy - NMR	
	Sept 2	15-1	Conjugated Systems, Dienes, UV Spectroscopy	
2	Sept 5	***		*** Monday ***** LABOR DAY – HOLIDAY ***
	7	15-2		
	9	15-3		
3	Sept 12	16-1	Aromatic Compounds	
	14	16-2		
	16	16-3		
4	Sept 19	17-1	Aromatic Compounds - Reactions	
	21	17-2		
	23	17-3		
5	Sept 26	***		*** MONDAY *** EXAM I (Chapters 15-17)
	28	18-1	Ketones and Aldehydes	
	30	18-2		
6	Oct 3	18-3		
	5	18-4		
	7	18-5		
7	Oct 10/11	***		*****Mon/Tues MIDTERM Break
	12	19-1	Amines	
	14	19-2		
8	Oct 17	19-3		
	19	19-4		
	21	19-5		
9	Oct 24			*** MONDAY *** EXAM II (Chapters 18-19)
	26	20-1	Carboxylic Acids	
	28	20-2		
10	Oct 31	20-3		
	Nov 2	21-1	Carboxylic Acid Derivatives	
	4	21-2		***** Friday ***** (last day to withdraw with a W) *****
11	Nov 7	21-3		
	9	22-1	Enols, Enolates, Alpha Substn of Carbonyls	
	11	22-2		
12	Nov 14	22-3		
	16	22-4		
	18	23-1	Carbohydrates	
13	Nov 21			*** MONDAY *** EXAM III (Chapters 20-22)
	23-25	***		***** Wed-Fri ***** THANKSGIVING DAY – HOLIDAY *****
14	Nov 28	23-2		
	30	23-3		
	Dec 2	23-4	Spectroscopy – NMR	
15	Dec 5	24	Amino Acids, Peptides, and Proteins	
	7	25	Lipids	
	9	***	Q/A	
16	Dec 16 - Friday		Cumulative FINAL EXAM, 4:15 – 6:15 pm, Flanner Auditorium	