



CHEMISTRY 27

THE ORGANIC CHEMISTRY OF LIFE

Instructors

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Course Description

Chemical principles that govern the processes driving living systems are illustrated with examples drawn from biochemistry, cell biology, and medicine. The course deals with organic chemical reactivity (reaction mechanisms, structure-reactivity relationships), with matters specifically relevant to the life sciences (chemistry of proteins, nucleic acids, drugs, natural products, cofactors), and with applications of chemical biology to medicine and biotechnology. An understanding of organic reactions and their “arrow pushing” mechanisms is required.

Lectures

Lectures will be delivered in the Science Center on Mondays and Wednesdays from 2:30 – 4:00 pm. Lecture attendance is extremely important as the lectures will be the primary source of material for all examinations.

Course Web Site

The course website will contain all course materials including this syllabus. We will be updating the website throughout the semester. You will be able to find the post-lecture slides as well as the lecture videos on the website. In addition, all of the PyMOL session files that were used to generate the figures in the lectures will be available on the website.

Lecture Course Books (Available at Flash Print)

Workbooks containing lecture pre-notes and background reading notes for the course are available for purchase from Flash Print at 99 Mt. Auburn St. in Harvard Square (available the first week of classes). There are two workbooks: one for the first half of the course and one for the second half. We ask that you bring your pre-notes with you to class and fill-in your pre-notes during lecture. The background reading notes will serve as a textbook for the course, specifically written to match the material being covered in each lecture. It is expected that you read the background notes for each lecture prior to attending lecture.

The Practice Problems Book is also at Flash Print. The practice problems will be used as material in section and you should bring your book with you to sections. These problems are designed to help you in studying the course material and preparing for the exams. The answers to each section of practice problems will be posted on the website each week.

Lab Course Materials (Available at Flash Print and the Harvard Coop)

The Chemistry 27 Lab Manual will also be available for purchase at Flash Print.

You will also need the following items for lab which are all available at the Harvard Coop:

- 1) The Organic Chem Lab Survival Manual (*Zubrick*)
- 2) Lab Notebook that makes copies (*either with carbon paper or carbonless will work*)
- 3) Pair of Safety Goggles

Clickers

We will be using personal response devices (clickers) in lectures. You can check one out from Cabot Library for the semester. If you already have one for another class, you may also use it for Chem 27 and do not need to get a second one from the library. Register your clicker online following the instructions on the course website. Then bring your clicker with you to every lecture so that you can participate in answering the clicker questions. You must use only your own clicker and cannot submit answers for another student.

Supplemental Readings

We will select a textbook chapter, article or review for each lecture as supplemental reading on the website. You should consult these references if you find that another resource would be helpful in your learning and understanding of the lecture material. These supplemental readings are not required and will not be used in problem sets or exams.

Problem Sets

You will be assigned a weekly problem set (20 points each) which will be posted on the website. Problem sets will be due on **Thursdays at 6pm**, and you will turn them in on the second floor of the Science Center in your TF's box. You may turn your problem set in early, but we will not accept any late problem sets. There will be a total of eight graded problem sets (PS1-8). (*Note: PS0 will not be graded.*) Problem set questions will be similar to exam questions. You may work with other students on your problem sets, but it is expected that the work you hand in is your own work.

Redo Problem Set Question

For each of the eight graded problem sets, you will have a chance to earn up to 2 points towards your weekly problem set score. After you turn in your problem set on Thursday, you should look over the answer key posted on the website that evening. You will have until **Friday at 1:00pm** to turn in an optional redo question to your TF's mailbox. You may choose any one question from the problem set, redo the question and provide a written explanation for why your new answer is better than your original answer. The 2 points for the redo question will be added to that week's problem set score up to 20 points total. [If for example your score on the problem set would have been 16 points and you complete a redo question, your problem set score for that week will be recorded as 18 points. If however, your problem set score would have been 19 points and you turn in a redo question, your problem set score for that week will be recorded as 20 points.]

Discussion Section and Laboratory Section

Sections and Labs will meet weekly beginning the week of **February 3** (except during Spring Break).

Online sign-up for Section and Lab Assignments: DEADLINE FRIDAY FEBRUARY 1 at 5PM

Go to <https://www.section.fas.harvard.edu/> to enter your preferences for section times. You will be able to enter your preferences from **Monday Jan. 27** until **Friday Jan. 31 at 5pm**.

Section and Lab times and room assignments will be emailed to you on Friday evening after sectioning has ended.

Discussion section attendance is mandatory for Chem 27, and the expectations for section include, but are not limited to, the following: 1) be prepared to discuss intelligently any lecture material since the last section, 2) be prepared to work problems, either in writing or in oral presentations at the blackboard.

You must attend and complete every laboratory section in order to pass Chem 27. Failure to complete a passing lab report for every experiment will result in a failing grade in the course.

Note: For students who have taken Chem 20/30 Lab, you are not required to take Chem 27 Lab section. The rest of your scores in the course will be scaled accordingly when determining your final course grade.

Peer Study Leaders

This semester we have four students who took Chem 27 last year serving as Peer Study Leaders (PSLs). The PSLs will serve as another resource for help in the course. The PSLs will lead weekly optional sections that are open to any students interested in attending. More information about the PSLs will be posted on the course website.

Office Hours

The Course Instructor, Preceptor, Section TFs and PSLs will all hold weekly office hours. A schedule of times and locations will be posted on the website. All office hours are open to all students in the course.

Exams

Three exams will be given during the course of the semester. All exams will be during class time and will begin at 2:30 pm and end at 4:00 pm. **No make up exams** will be permitted. If you miss one of the three exams, it will count as your dropped exam. There will be a review session prior to each exam.

Semester Exam 1	Wednesday February 26	(covering lectures 1-5)
Semester Exam 2	Wednesday April 2	(covering lectures 6-12)
Semester Exam 3	Wednesday April 30	(covering lectures 13-19)

Final Exam	TBA (May 9 or May 17)	(cumulative lectures 1-21)
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Special Accommodations for Exams

We understand that some students may require special accommodations for exams. If this applies to you, please contact the Preceptor, Dr. Marie Spong (spong@fas.harvard.edu) within the first two weeks of the course so that we have enough time to make arrangements before the first exam. We will ask you to obtain a letter from the Harvard Accessible Education Office describing the particular accommodations you will need.

Course Policy on Collaboration:

Problem Sets - Discussion and the exchange of ideas are essential to doing academic work. For weekly problem sets in this course, you are encouraged to consult with your classmates as you work on these assignments. However, after you have discussed the homework with peers, make sure that you can work through the problems yourself and ensure that any answers you submit for evaluation are the result of your own efforts. In addition, you must cite any books, articles, websites, lectures, etc that have helped you with your work using appropriate citation practices. Similarly, you must list the names of students with whom you have collaborated on problem sets.

Clickers - You must use only your own clicker and cannot submit answers for another student.

Exams - Your work on the three in-class exams and the final exam must be your own work. You may not discuss the exam problems with any other students, and you may not use any notes or other sources while you are taking the exams.

Grading

Plan A

10% Discussion section (Attendance + participation)
10% Problem sets (Each problem set will be worth 20pts.)
10% Laboratory section
4% Clicker Questions from Lecture
49.5% Semester Exams (counting all three exams and each exam worth 16.5%)
16.5% Final Exam

or

Plan B

10% Discussion section (Attendance + participation)
10% Problem sets (Each problem set will be worth 20pts.)
10% Laboratory section
4% Clicker Questions from Lecture
33% Semester Exams (drop your lowest exam score and the two remaining exams each counting 16.5%)
33% Final Exam

This means we will either drop one of your three semester exam scores or half of your final exam score. We will automatically use whichever grading scheme will give you the higher overall score to determine your letter grade in the course.

Letter Grades

After we have calculated your score using the grading scheme that gives you the higher overall score, we will assign letter grades according to a numeric scale. The approximate ranges for grades from past years are shown below. (The exact cutoffs for letter grades, including the + and – grades, are left to our discretion and will not be decided until after the final exam.)

87.5 – 100	A– or A
72 – 87.5	B–, B, or B+
55 – 72	C–, C, or C+
45 – 55	D
below 45	F

CHEM 27 CALENDAR SPRING 2014

Day	Date	Lecture	Biological/Medical Topic	Chemical Topic	Lecturer
Mon	Jan 27	Lecture 0	Introduction to Chem 27	Introduction to Chem 27	EB/MS
Wed	Jan 29	Lecture 1	Enzymes and Sugars – Part 1	Carbonyl Chemistry	EB/MS
Mon	Feb 3	Lecture 2	Enzymes and Sugars – Part 2	Carbonyl Chemistry	EB
Wed	Feb 5	Lecture 3	Kinases and Polysaccharides	Phosphate Chemistry	MS
Thurs	Feb 6		<i>Answer Key to <u>PS0</u> will be posted (You do not turn in PS0)</i>		
Mon	Feb 10	Lecture 4	Enzyme Inhibitors as Drugs	Enzyme Kinetics and Inhibition	EB
Wed	Feb 12	Lecture 5	Hypertension	Proteases	EB
Thurs	Feb 13		<i>Turn in <u>PS1</u> by 6PM</i>		
Mon	Feb 17		No Lecture - Presidents' Day		
Wed	Feb 19	Lecture 6	Cancer/Bortezomib	Proteasome	EB
Thurs	Feb 21		<i>Turn in <u>PS2</u> by 6PM</i>		
Mon	Feb 24	Lecture 7	Glycolysis	Aldolase Reaction	MS
Mon	Feb 24		<i>Exam Review Session 4-6pm in Location TBD</i>		
Wed	Feb 26		Exam I (Lectures 1-5)		

Mon	Mar 3	Lecture 8	Fatty Acid Biosynthesis	Assembly Line Enzymology: Claisen Condensations 1	EB
Wed	Mar 5	Lecture 9	Erythromycin Antibiotic	Assembly Line Enzymology: Claisen Condensations 2	EB
Thurs	Mar 6		Turn in <u>PS3</u> by 6PM		
Mon	Mar 10	Lecture 10	Vancomycin Antibiotic	Assembly Line Enzymology: Nonribosomal Peptides	EB
Wed	Mar 12	Lecture 11	Cholesterol Biosynthesis	Carbon Alkylations: Isoprenyl Transfers	EB
Thurs	Mar 13		Turn in <u>PS4</u> by 6PM		
No Classes – Spring Recess – March 15-March 23					

CHEM 27 CALENDAR SPRING 2014 (cont.)

Day	Date	Lecture	Biological/Medical Topic	Chemical Topic	Lecturer
Mon	Mar 24	Lecture 12	Pyruvate Decarboxylase	Acyl Carbanion Equivalent: Thiamine	EB
Wed	Mar 26	Lecture 13	African Trypanosomiasis	Pyridoxal Phosphate and Amino Acid Decarboxylations	EB
Thurs	Mar 27		Turn in <u>PS5</u> by 6PM		
Mon	Mar 31	Lecture 14	Liver Damage	Other PLP-catalyzed Reactions	MS
Mon	Mar 31		Exam Review Session 4-6pm in Location TBD		
Wed	Apr 2		Exam II (Lectures 6-12)		

Mon	Apr 7	Lecture 15	Cancer Chemotherapy	Transfer of One Carbon Fragments	MS
Wed	Apr 9	Lecture 16	Cardiovascular Disease/Statins	Hydride Transfer	MS
Thurs	Apr 10		Turn in <u>PS6</u> by 6PM		
Mon	Apr 14	Lecture 17	Detoxification of ROS	Flavin-based Coenzymes-1	EB
Wed	Apr 16	Lecture 18	Citric Acid Cycle	Flavin-based Coenzymes-2	EB
Thurs	Apr 17		Turn in <u>PS7</u> by 6PM		
Mon	Apr 21	Lecture 19	Glycolysis	Oxidation of Glucose	EB
Wed	Apr 23	Lecture 20	Citric Acid Cycle and Electron Transport Chain	Oxidation of Glucose	EB
Thurs	Apr 24		Turn in <u>PS8</u> by 6PM		
Mon	Apr 28	Lecture 21	Chemistry of the Human Microbiota		EB
Mon	Apr 28		Exam Review Session 4-6pm in Location TBD		
Wed	Apr 30		Exam III (Lectures 13-19)		

Mon	May 5	Reading Period	Final Exam Review Session 2:30-4:00pm in Location TBD		
Wed	May 7	Reading Period	Final Exam Review Session 2:30-4:00pm in Location TBD		
TBD	May 9 or 17	Final Exam Period	Final Exam (Lectures 1-21)		