Organic Chemistry II

CHM 224

MW 8:00 am – 9:30 am, Dow L2

Problem Solving Session (optional), Fridays 8:00 am - 9:30, Dow L2

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Office Hours: M/T/W/F 10:15 - 11:15, Th 12:45-1:45, or by appointment

Supplies (required)

Textbooks:

Organic Chemistry, 8th Edition, John McMurry, 2012

Microscale Organic Laboratory, 5th Edition, Dana W. Mayo, Pike, Forbes 2011

Z87 approved eye protection

Bound laboratory notebook

Optional Supplies

Study Guide and Solutions Manual (also on reserve in library)

Molecular model set

Website: http://DrTChemistry.com

Office Hours: The office hours above are times during each week that I make myself available for you. If the times listed do not coincide with your availability, please let me know in class or contact me via email so we can arrange an appropriate meeting time.

Tips for Success: Welcome to the second term of Organic Chemistry. Learning the basic principles of organic chemistry is very important, however memorization will get you only so far in this course, rather consider looking at the mechanistic rational behind chemical reactions and try to reason your way through them. When one understands basic concepts such as orbitals, acids, bases, electrophiles, and nucleophiles, this course becomes much easier. Two important keys to success in this class are (1) not falling behind, and (2) working the problems at the end of each chapter. In comparison, one who completes the latter should do far better in this course than someone whose only preparation for the examinations is reading the textbook. Please see me during office hours or make an appointment if you're having difficulties with these problems or any of the course material. According to standards created by the Higher Learning Commission, it is expected that you should be spending 8 to 12 hours per week working on out of classroom assignments (including homework).

Format of Lectures: You will be expected to read the planned chapter content for the day PRIOR TO COMING TO CLASS. This is important because I will try to keep my 'lecturing' to a minimum, while leaving more time for group work and problem solving.

Examinations and Grading: There will be two examinations followed by a comprehensive final exam. The examinations will reflect material covered in lecture and lab. Each exam will contain at least one question taken directly from the list of recommended textbook problems – these should be free points! Quizzes will also come from this list (6 quizzes, drop lowest grade). Your course grade will be determined by the total points acquired during the term. Graded assignments that have not been retrieved 30 days after grading will be shredded. Re-grading requests must be made within 48 hours of receipt of the exam. This syllabus is tentative and may change without notice. Academic dishonesty will be dealt with vigorously and will result in a zero for the exam/assignment.

Two Mid-Term Exams (100 points each):	200 pts. (40%)	Approximate	A	90%
Comprehensive Final Exam:	100 pts. (20%)	Grading	AB	88.5%
Literature Assignment:	50 pts. (10%)	Scale	B	80%
Quizzes:	50 pts (10%)		BC	78.5%
Homework:	50 pts (10%)		C	70%
Laboratory work:	50 pts. (10%)		CD	68.5%
			D	60%
Total =	500 pts.		DE	58.5%

Lecture Schedule

(topic schedule is tentative, exam schedule is not)

Date	Chapter
	Chapter 12: Structure Determination: Mass Spectrometry and Infrared Spectroscopy
	Chapter 13: Structure Determination: Nuclear Magnetic Resonance Spectroscopy
	Chapter 11: Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations
	Chapter 14: Conjugated Compounds and Ultraviolet Spectroscopy
October 17	**Mid-Term Exam 1**
	Chapter 15: Benzene and Aromaticity
	Chapter 16: Chemistry of Benzene: Electrophilic Aromatic Substitution
	Chapter 17: Alcohols and Phenols
	Chapter 18: Ethers and Epoxides; Thiols and Sulfides
November 19	**Mid-Term Exam 2**
	Chapter 19: Aldehydes and Ketones: Nucleophilic Addition Reactions
	Chapter 20: Carboxylic Acids and Nitriles
	Chapter 21: Carboxylic Acid Derivatives: Nucleophilic Acyl Substitution Reactions
December 13	**Final Exam (cumulative), 9:00 AM - 11:00 AM**

Recommended Textbook Problems

Topic (Chapter)	Recommended Textbook Problems
Mass Spectrometry Infrared Spectroscopy (Ch 12)	14, 17, 18, 21, 23 - 27, 30, 32, 35, 36, 41, 44
Nuclear Magnetic Resonance Spectroscopy (Ch 13)	33 - 36, 38, 40, 42 - 45, 47 - 49, 51 - 55, 59 - 61 and spectroscopy questions at the end of Ch 16 - 23
Reactions of Alkyl Halides (Ch 11)	27 - 32, 34, 36, 38, 40 - 42, 44, 45, 48 - 54, 57, 58, 61, 64, 65, 67 - 72
Conjugated Compounds and Ultraviolet Spectroscopy (Ch 14)	21 , 23, 25, 26, 28, 29, 31 - 35, 39, 41, 44, 45, 48 - 50, 54 - 56, 58, 59
Benzene and Aromaticity (Ch 15)	18 (b-f), 19, 24, 29 - 34, 38, 42-25
Chemistry of Benzene (Ch 16)	28 - 36, 39-48, 51, 52, 54, 59, 62, 64 - 66, 68, 72 - 74
Alcohols and Phenols (Ch 17)	25, 29, 30 - 32, 34 - 37, 39 - 43, 50, 52 - 59, 62, 65, 66
Ethers, Epoxides, Thiols and Sulfides (Ch 18)	23, 25 - 33, 41, 43, 44, 49, 53, 55, 56
Aldehydes and Ketones (Ch 19)	30, 34 - 37, 38 (skip c), 39 - 40, 47, 48, 51 - 53(skip c), 56, 61, 64, 73
Carboxylic Acids and Nitriles (Ch 20)	21, 26, 27, 31, 40
Carboxylic Acid Derivatives (Ch 21)	34, 37 - 39, 42

Laboratory: Laboratory is begins at 1:10 PM and ends at 4:20 PM. The time needed to complete the laboratory will depend on the experiment and your preparedness. Subject to limitations of space and equipment, lab days may be switched as long as the same experiment is still in progress and arrangements have been made in advance with Dr. Burns. Absences occasioned by illness or other legitimate reasons are excused by a memo from a physician or the office of Student Life. Please consult with Dr. Burns as soon as possible to discuss any possible make-up laboratory activity. Unexcused absences will result in a zero and may result in failure for the course. Preparation for the laboratory includes reading the laboratory and supporting material, and preparing your notebook in advance. Notebooks will be checked before the start of the laboratory period to ensure a safe and productive laboratory period. Post-lab Questions, reflecting the day's experiment, will be collected at the end of each laboratory. Proper attire and Z87 approved protective eyewear must be worn during the course of the laboratory. Safety rules should be followed at all times. Lack of compliance will result in expulsion from the laboratory.

Handouts and other documents/information will be placed on the CHM 224L Moodle page. Please check Moodle as you are doing your weekly preparation for any additional information.

Grading:
The laboratory grade will be based on your post-lab questions (10 pts each week) and a notebook quality check (10 pts for the term). Your overall score (percentage) in the laboratory will be reported to your lecture instructor, and for Dr. Turk's sections of CHM 224, laboratory work comprises 8% of the overall course grade.

Laboratory Schedule

Date	Itinerary
Sept 10 - 13	Exp 33A - Chromium Trioxide Oxidation of an Alcohol
Sept 17 - 20	Exp 5B - Sodium Borohydride Reduction of trans-4-tert-butylcyclohexanone
Sept 24- 27	Handout - Structure Determination of an Unknown Using Spectroscopic Methods
Oct 1 - Oct 4	Exp 22A - Williamson Synthesis of Propyl p-tolyl Ether
Oct 8 - 11	Exp 14 - Diels-Alder Reaction
Oct 17 - 18	Handout - Luminol *(Note: Wednesday and Thursday lab sections only)*
Oct 22 - 25	Exp 29D - Nitration of Phenol
Oct 29 - Nov 1	Exp 17 - Grignard Reaction with an Aldehyde
Nov 5 - 8	Handout - Self directed Synthesis of an Ester
Nov 12 - 15	Exp 23A - Amide synthesis - Acetanilide OR Handout - Synthesis of Acetaminophen
Nov 19 - 20	Handout - Luminol *(Note: Monday and Tuesday lab sections only)*
Nov 26 - 29	Exp 20 - Aldol Condensation: Dibenzalacetone
Dec 3 - 6	Exp A3a - Aldol Condensation - Tetraphenylcyclopentadienone Exp A4ab - Diels Alder - Hexaphenylbenzene

Instructions for Journal Article Assignment

Articles published in the chemical literature can be an excellent source of information whether you are studying for an exam, preparing to run a new reaction in the course of a research project, or are just interested in learning about what's new and exciting in an area of science.

Assignment summary: Each student will submit a two to five page unique written assignment that contains a 1) *summary* and 2) *review* of a journal article, and 3*) an arrow-pushing mechanisms for two synthesis steps* found within the article. You can choose to work independently or in pairs; however, each student will be required to submit their own *original* report in the end. The article, with approval from the instructor, must relate to the *synthesis* of a biologically active organic compound and/or potential drug.

Acceptable journal articles:

1. *The focus of your chosen article must be centered around organic synthesis.* Such articles will usually contain at least one synthetic scheme and a description of the synthetic steps required to make "compound X". Since you're required to present *two* arrow-pushing mechanisms, make sure your synthesis scheme has at least two unique synthetic steps.

2. *The article must be current.* Articles should be chosen from the recent literature - no earlier than the 1st of this year.

3. *Choose a smaller, more manageable article.* The journal article chosen must be either a "communication", "brief article", "letter", or "note" – these are shorter versions of full research articles.

4. *Your article must be chosen from one of the following journals* (the respective designation for these shortened research articles is listed next to each journal - TOC stands for table of contents!).

Journal of the American Chemical Society – "Communications" (found in TOC before full articles)
Journal of Medicinal Chemistry – "Brief Articles" (found in TOC before full articles)
Journal of Organic Chemistry – "Notes" (found in TOC after full articles)
Organic Letters – All articles are OK
ACS Medicinal Chemistry Letters - All article are OK

How to search for an article: All journals listed above are published by the American Chemical Society (ACS) and can be accessed, free of charge, electronically at http://pubs.acs.org. You must use a computer connected to the Alma College network, as our electronic subscription is restricted to Alma College use only. From the ACS Publications web page you can search articles by author, title, abstract, or keyword. You may find the advanced search option provides better and more focused results. For example, you might search for the word "synthesis cancer" that appears in the title, or the words "antibiotic" in the abstract. *Sometimes the supporting information can be useful* - some publications have a document or two that accompany the main research article. This usually contains experimental other fine details not needed in the primary article.

Timeline: To help avoid a stack of papers on my desk all at once, please feel free to turn in approvals or drafts ahead of their deadlines.

Date	Action
Sept. 26	Submit the article for approval (print or email me the link/PDF). If you are working with a partner, only one submission for approval should be turned in - just make sure you list each person's name..
Oct. 24	Draft project due for review / comment
Nov. 21	Final report due (two to five pages ~ 500 words)

Components of the journal article assignment: To be submitted by each student - those who chose to work with a partner must prepare their own *original* report. Plagiarism/copying will result in a failing grade.

Aside from summarizing and reviewing the article, you must to pick TWO chemical reactions from the synthesis scheme(s)., and draw an arrow-pushing mechanism for each. You'll be amazed that as the semester draws to an end, how much of the synthetic aspect of your paper you'll begin to understand. If you don't understand the chemistry going on, that's OK - take this opportunity to do some learning on your own ;-)

A note about your writing style:

Write as though your audience has general scientific knowledge and is competent in organic chemistry but has no prior knowledge of the research your paper covers. Please reference compound numbers and figure/table designations as "compound **4**" or "figure 3", rather than "the molecule on the bottom of page 2". Do not write as though you are writing for me; if you do, you will tend to leave out important details by assuming that the reader already knows what your article is about.

When reading scientific journal articles, the overall style of writing is maybe not what you are used to. Authors that publish in journals published by the American Chemical Society are bound by rules and styles that are designated by the specific journal; you'll find the writing styles among each of the ACS journals are quite similar. For your assignment, I would prefer you emulate this writing style to the best of your ability. Assume your "article" is going to be published in a new journal that specializes in summarizing research results for those that don't have the time to read the whole thing (like me!)...

Here are some things to think about when you are reading and writing (not in any particular order). You may find reviewing the article, rather than summarizing it, is more complicated. To help, look for the **(R)**, below, that may relate to your critical review of the published work.

a. Before you can evaluate it, you must understand it. Use your resources: organic textbook, internet, peers, ME, etc.
b. Why is this research important?
c. What is the goal of this research?
d. What is the overall outcome of this research (sometimes it is different from the initial goal) and what are the future directions the authors may take?
e. Does the design of the experiment(s) fully address the problem or answer the hypothesis? **(R)**
f. Are the results convincing? Are any of the results surprising? **(R)**
g. What is the main point of this journal article?
h. Are there particular strengths or weaknesses of the article that you find relevant? **(R)**
i. Are there any questions the authors did not answer? What aspects of the original question remain unanswered (if any)? **(R)**
j. Was the research complete? Did it fully answer the initial hypothesis or solve the original problem? **(R)**
k. Are there any results that the authors do not completely understand?
l. What are the directions for future work?
m. How does the journal article contribute to the field of chemistry? **(R)**
n. What have you learned? **(R)**
o. Would you recommend the article to other students? **(R)**
p. Describe the quality of the research. **(R)**

Don't forget you need TWO mechanisms - I am happy to help. HOWEVER - Please use all the resources available to you (textbook, internet, searching cited references...) before you come see me. If all you have done is looked through your classroom notes or book and come to the determination that you "...don't know how to do this", then I'll probably tell you that you haven't looked enough. There are answers out there, you just have to go looking for them.