Organic Chemistry II

CHM 224

MWF 10:30 am – 11:20 am (section .01) - Dow L2

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Office Hours: MWF 8:30 - 9:30, TH 11:30, 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. Among other things, please use these if you are having difficulties with the problems at the end of each chapter or with any other course material.

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. More than any other courses you've probably taken, this course is cumulative. 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. Having said this, it will be expected of you to have read the planned chapter material prior to attending lecture - there. Please see me during office hours or make an appointment if you're having difficulties with these problems or any of the course material. It is expected that you will spend, on average, 8 to 12 hours per week working on out of classroom assignments.

Examinations and Grading: There will be three 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 those at the end of the textbook chapters – these should be free points! Quizzes will also come from the textbook (5 quizzes, drop lowest grade). Your course grade will be determined by the total points acquired during the term and curved to reflect your standing in the class. 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.

Three Exams (100 points each):	300 pts. (48%)
Comprehensive Final Exam:	100 pts. (16%)
Literature Assignment:	50 pts. (8%)
Quizzes:	20 pts (3%)
Homework:	50 pts (8%)
Smart Sparrow Beta	50 pts (8%)
Laboratory work:	50 pts. (8%)
Total =	620 pts.

Approximate Grading Scale		
	A	90%
	AB	88.5%
	B	80%
	BC	78.5%
	C	70%
	CD	68.5%
	D	60%
	DE	58.5%

Lecture Schedule

Date		Itinerary (Chapter)	Recommended Textbook Problems
Sept	7	Mass Spectrometry (12.1 – 12.4)	14, 17, 18, 21, 23 - 26
	9, 12	Mass Spec and Infrared Spectroscopy (12.5 – 12.8)	27, 30, 32, 35, 36, 41, 44
	14, 16, 19, 21	Nuclear Magnetic Resonance Spectroscopy (13)	33 - 36, 38, 40, 42 - 45, 47 - 49, 51 - 59, 60 - 65 and spectroscopy questions at the end of Ch 16 - 23
Oct	23, 26, 28, 30 3, 5, 7	Reactions of Alkyl Halides (11)	27 - 32, 34, 36, 38, 40 - 42, 44, 45, 48, 49 - 54, 57, 58, 61, 64, 65, 67 - 72
	10	Exam I	
	12 , 14	Conjugated Dienes and Ultraviolet Spectroscopy (14)	21 , 23, 25, 26, 28, 29, 31 - 35, 39, 41, 44, 45, 48 - 50, 54 - 56, 58, 59
	19, 21, 24, 26, 28 31	Aromatic Compounds and their Synthesis (15, 16)	Ch 15: 18 (b-f), 19, 24, 29 - 34, 38, 42 - 45. Ch 16: 28 - 36, 39-48, 51, 52, 54, 59, 62, 64 - 66, 68, 72 - 74
Nov.	2, 4	Alcohols and Phenols (17)	25, 29, 30 - 32, 34 - 37, 39 - 43, 50, 52 - 59, 62, 65, 66
	7	Exam II	
	9, 11	Ethers, Epoxides, Thiols and Sulfides (18)	23, 25 - 33, 41, 43, 44, 49, 53, 55, 56
	14, 16, 18, 21, 23	Aldehydes and Ketones (Preview and 19)	30, 34 - 37, 38 (skip c), 39 - 40, 47, 48, 51 - 53(skip c), 56, 61, 64, 73
	28, 30	Carboxylic Acids and Derivatives (20, 21)	Ch 20: 21, 26, 27, 31, 40 Ch 21: 34, 39, 42
Dec	2	Exam III	
	5, 7, 9	Carboxylic Acid Derivatives (21, continued) Condensation Reactions (22, 23 - selected sections)	Ch 22: 20, 23, 25, 28, 37, 43, 47 Ch 23:
	12	FINAL EXAM - Monday, 7 pm – 9 pm	

Laboratory: Laboratory is scheduled for a four hour period, beginning at 1:00 PM. The time needed to complete the laboratory will depend on the actual 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 224 Moodle page. Please check Moodle as you are doing your weekly preparation for any additional information for that week's laboratory.

Grading:
The laboratory grade will be based on your post-lab questions (10 pts each week) and a notebook quality check (15 checks each week, 10 pts for the term). Your percentage in the laboratory will be reported to your lecture instructor, and for Dr. Turk's section of CHM 224, laboratory work comprises 9% of the overall course grade.

Laboratory Schedule

Date	Itinerary
Sept 12 - 15	Exp 33A - Chromium Trioxide Oxidation of an Alcohol
Sept 19 - 22	Exp 5B - Sodium Borohydride Reduction of trans-4-tert-butylcyclohexanone
Sept 26- 29	Exp 22A - Williamson Synthesis of Propyl p-tolyl Ether
Oct 3 - Oct 6	Handout - Structure Determination of an Unknown Using Spectroscopic Methods
Oct 10 - 13	Exp 14 - Diels-Alder Reaction
Oct 19 - 20	Handout - Luminol *(Note: Wednesday and Thursday lab sections only)*
Oct 24 - 27	Exp 29D - Nitration of Phenol
Oct 31 - Nov 3	Exp 17 - Grignard Reaction with an Aldehyde
Nov 7 - 10	Handout - Self directed Synthesis of an Ester
Nov 14 - 17	Exp 23A - Amide synthesis - Acetanilide OR Handout - Synthesis of Acetaminophen
Nov 21 - 22	Handout - Luminol *(Note: Monday and Tuesday lab sections only)*
Nov 28 - Dec 1	Exp 20 - Aldol Condensation: Dibenzalacetone
Dec 5 - 8	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*, 2) *review*, and 3*) mechanisms for two synthesis steps* of a journal article. You can choose to work independently or in pairs (no more than two in a group); 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 medicinally active organic compound and/or potential drug.

Acceptable journal articles: *Your article must have some element of organic synthesis within it.* Such articles will usually contain at least one synthetic scheme and a description of the synthetic steps required to make "compound X".

The journal article chosen must be either a "communication", "brief article", "letter", or "note" – these are shorter versions of full research articles. The article must be current - being published no earlier than the 1st of this year. See the list below for acceptable journals and the respective designation for these shortened research articles (TOC stands for table of contents!).

Journal of the American Chemical Society – Communication (placed in TOC before full articles)
Journal of Medicinal Chemistry – Brief Article or Letter (placed in TOC before full articles)
Journal of Organic Chemistry – Note (placed in TOC after full articles)
Organic Letters – All articles are OK

All journals listed above are published by the American Chemical Society (ACS) and can be accessed electronically at http://pubs.acs.org. You must use a computer connected to the Alma College network, as our electronic subscription is restricted to on-campus use only. From the ACS 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 "cancer" that appears in the title, or the words "synthesis antibiotic" in the abstract. Some articles have a document that contains supporting information (typically experimental) that you may find helpful.

Timeline: If you are working with a partner, only one submission for approval must be turned in - just make sure each person's name is given. To help avoid a stack of papers on my desk all at once, please feel free to turn in approvals, drafts, or final projects ahead of their deadlines.

Date	Action
Sept. 28	Submit the article (print or email me the link/PDF) for approval
Oct. 19	Draft project due for review and comment
Nov. 23	Final report due (approx. 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, I want you to pick TWO chemical reactions from the scheme(s), draw a mechanism for each and discuss the reactions. That is, talk about the reagents used and how they react with the starting materials to produce the products. If the reactions have a name associated with it (like the Williamson ether synthesis), please mention it. 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.

A note about your writing style:

Write as though your audience 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", for example, 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. For the most part, 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!)...

Things to think about when you are reading and writing (not in any particular order)

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?
f. Are the results convincing? Are any of the results surprising?
g. What is the main point of this journal article?
h. Are there particular strengths or weaknesses of the article that you find relevant?
i. Are there any questions the authors did not answer? What aspects of the original question remain unanswered (if any)?
j. Was the research complete? Did it fully answer the initial hypothesis or solve the original problem?
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?
n. What have you learned?
o. Would you recommend the article to other students?
p. Describe the quality of the research.

Don't forget you need TWO mechanisms - I am happy to help. HOWEVER - Please use all the resources available to you (textbook, internet, searching references...) before you come see me. If all you have done is stared at the mechanism and figured, "well, I don't know how to do this", then that is not enough., and I will tell you so. There are answers out there, you just have to go looking for them.

Instructions for Smart Sparrow Lessons

Grading: Your scores on these assignments (as a %) will be multiplied by 50 to provide me with the appropriately scaled score to record in my grade-book. For example, if your overall lesson scores are 84% correct, then you will earn 42 out of 50 points for the Smart Sparrow Beta portion of the lecture grade.

Instructions:

1) You will need to register for a username and password for SciFinder/CAS. Because this method of creating a username and password requires a specific IP range, this will have to be done ON CAMPUS. You must also USE YOUR ALMA COLLEGE EMAIL ADDRESS when registering, even if you have your mail forwarded to another account. This is how SciFinder associates the user with an institution.

After the required information is entered (i.e. name, email, username and password, etc), a message will be sent to your email address, with a link to confirm registration. You must confirm registration within 48hrs or the registration becomes void and the link will no longer work.

The link to register is: https://scifinder.cas.org/registration/index.html?corpKey=AD68ABD1-86F3-5055-2F87-6955759C0CDD

This must be EXACT. You can click on the link above (if viewing this as a PDF); I'll also send it by email.

2) Your Alma College email address is used to register you with Smart Sparrow (I have done this for you), and links to a variety of lecture-relative lessons will be sent to you - simply click on the link and complete the lesson. Each lesson is about between 5 and 10 questions in length.

The following lesson titles will be assigned and are relevant to the following chapters:

Chapter 16
Electrophilic Aromatic Substitution

Chapter 17
Alcohols and Thiols as Nucleophiles

Chapter 18
Williamson ether synthesis in Drug Delivery Systems

Chapters 19
Grignard reactions of aldehydes and ketones
Ketone Chemistry and Triquinanes

Chapters 20, 21
Carboxylic ester and lactone synthesis
Catalysts for direct esterification and amidation of carboxylic acids

Chapters 22, 23
Pupukeanane natural products
Alpha-Carbon Alkylation Reactions in Alkaloid Synthesis