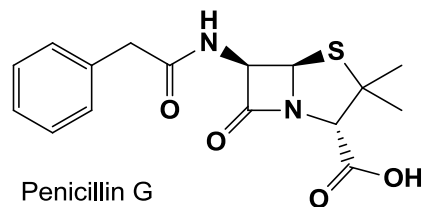


CHEMISTRY 220

FALL 2014 SYLLABUS



Instructor: Dr. Holly D. Bendorf

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Home: (570) 998-8647 (no later than 10:00 pm, please!)

Course Schedule: Class: MWF 9:00 - 10:05, Heim G-09
Labs: T 7:45 - 11:35 am, T 1:00 - 4:50 pm, or Th 7:45 - 11:35 am.
Prelab is in Heim 220. Lab meets in Heim 236.

Office Hours: Walk-in or by appointment. If you need to reach me outside of regular work hours, feel free to *call* me at home (this is a landline, so no texts please!). I rarely check my work e-mail account from home, so if you need to reach me on an evening or weekend, please use the home phone number listed above.

Evening Review Session: I will hold an evening review session one night each week. The review session provides an informal way for us to get together, work problems, talk chemistry and answer questions. While no one meeting time will work for everyone, I will select a time that works for as many people as possible.

Course Description: CHEM 220, Organic Chemistry I, is an introduction to the study of the chemistry of carbon compounds. The course covers the chemistry of alkenes and alkynes, the substitution and elimination chemistry of alkyl halides, the theory and applications of infrared spectroscopy, and the strategies of organic synthesis. The laboratory portion of the course will introduce the student to a variety of techniques for the synthesis, purification, and analysis of organic compounds.

Prerequisite: Successful completion of CHEM 111.

Course Objectives: Upon completion of this course, each student should be able to:

1. Discuss bonding in organic compounds in terms of the major theories and the role played by hybridization.
2. Identify potential sites of chemical reactivity based on molecular structure.
3. Draw organic molecules and name them according to IUPAC nomenclature rules.
4. Recognize the impact that the 3-dimensional nature of molecules has on chemical behavior and be able to identify conformational and stereoisomers.
5. Predict products and propose mechanisms for reactions of alkenes, alkynes, and alkyl halides.
6. Propose multi-step syntheses of small molecules.
7. Use infrared spectroscopy, polarimetry, and physical properties to characterize molecules of known structure and identify molecules of unknown structure.
8. Demonstrate proficiency with standard organic laboratory techniques for the synthesis and purification of organic compounds.

This course helps students achieve the following Chemistry Department learning objectives:

1. Exhibit proficiency in the major sub-disciplines of chemistry
2. Perform wet laboratory techniques as appropriate to the major sub-disciplines of chemistry
3. Understand and use modern chemical instrumentation
4. Exhibit integrative, problem-solving skills, such as experimental design, data manipulation, and data interpretation
5. Demonstrate responsible conduct in the laboratory, including laboratory safety and ethical research practices

This course supports the mission of Lycoming College to provide a distinguished baccalaureate education in the liberal arts and sciences.

Required Text and Materials:

- "Organic Chemistry" 8th Edition, John McMurry, Brooks Cole Publishers.
- CHEM 220 Course Supplement.
- CHEM 220-221 Lab Manual.
- Model Kit: Organic Chemistry Set 1013A (HGS models / Maruzen)
- Bound laboratory notebook (Freeman).
- Safety glasses or goggles.
- Casio fx-260 calculator (same one used in CHEM 110-111, only needed for the laboratory quizzes)

Optional Materials:

- "Organic Chemistry as a Second Language" 3rd Edition, David Klein.
I'll put a copy of this text on reserve in the library.
- "Study Guide and Solutions Manual for Organic Chemistry" John McMurry.
I'll post answer keys for the assigned homework on Moodle, so there is no need to buy this manual unless you REALLY want a copy.
- Study guide for the ACS Exam in Organic Chemistry. *Good source of practice problems.*
Available at: <http://chemexams.chem.iastate.edu/>

Grading Criteria:	Quizzes	105 points
	Exams	300 points
	Laboratory	110 points
	Final	<u>135 points</u>
		650 points

Final grades are assigned as follows:

A 585-650 points (90.0 – 100%)	B 520-584 points (80.0 – 89.9%)
C 455-519 points (70.0 – 79.9%)	D 390-454 points (60.0 – 69.9%)

Plus and minus grades are included in these ranges and correspond to the highest and lowest 2%, respectively.

Please be aware that you must pass both the lecture and laboratory to receive a passing grade for the course. Be sure to keep a record of your quiz, exam, and lab grades. Don't forget to keep track of your colloquium attendance and any absences, too. You can calculate your average at any time during the semester as follows: $\% = [\text{Total points earned} / \text{total points possible}] * 100$.

Final Grade	Final Average	Interpretation (from the Lycoming College Catalog)
A	>90%	Excellent: Signifies superior achievement through mastery of content or skills and demonstration of creative and independent thinking.
B	80-90%	Good: Signifies better-than-average achievement wherein the student reveals insight and understanding.
C	70-80%	Satisfactory: Signifies satisfactory achievement wherein the student's work has been of average quality and quantity. The student has demonstrated basic competence in the subject area and may enroll in additional coursework.
D	60-70%	Passing: Signifies unsatisfactory achievement wherein the student met only the minimum requirements for passing the course and should not continue in the subject area without departmental advice.
F	<60%	Failing: Signifies that the student has not met the minimum requirements for passing the course. A failing grade in the course may also result from academic dishonesty or from excessive unexcused absences.

Exams: There are three in-class exams on the following dates: **Friday, September 26; Friday, October 24;** and **Friday, November 21**. The final exam is at **8:30 am** on **Tuesday, December 9**. The final exam is cumulative and is similar in format to the mid-semester exams. Please note that the ACS exam in organic chemistry, given at the end of CHEM 221, is cumulative for the entire year.

Quizzes: Quizzes are an incentive to stay current with the course. They provide you with a means of evaluating your progress and allow you to identify any potential "trouble spots" before the exam. Quiz questions come from the lecture notes, reading and homework assignments. The lowest quiz grade is dropped.

A note about exams and quizzes: While only the final exam is cumulative, you should realize that each topic covered this semester builds upon topics from earlier sections of the course. Therefore, all quizzes and exams are essentially cumulative in nature. Simply cramming the night before a quiz or exam *might* work early in the semester, but you will pay for it later. **Don't fall behind in this class or the work will "snowball" on you.** Study every day. Don't just memorize random facts...instead, work to understand the material. Test your understanding by trying to explain/teach the concepts to a classmate. If you are having trouble with the material, get help (come see me!) right away.

Reading Assignments from the Text: Chapter outlines, reading and homework assignments are listed in the course supplement. I suggest you skim the reading assignment before class and read it again more thoroughly afterwards. I strongly recommend taking notes on the reading. Taking notes forces you to summarize the reading in your own words and helps to reinforce the concepts. You will also find these notes to be very helpful as you prepare for exams and quizzes.

Homework Assignments: If you want to succeed in this course, it is essential that you complete the homework assignments. Give each problem your best shot before consulting the answer key. If you get a question wrong, make an effort to correct any errors or misconceptions. If you are having trouble with the homework, take time to review your notes, re-read the appropriate section in the text and work the solved problems in the text. Then go back and try the homework again. Of course, you are always welcome to ask me for extra help with the questions on the homework or reading assignments. Lectures and in-class exercises are prepared with the expectation that you have read the assigned material and completed the homework.

Attendance at class and lab: Regular attendance at lecture is mandatory. This means that I expect you to arrive on time, remain in class for the entire 65 minutes, and participate in class. Missing part of a class (late arrival, early departure, etc.), sleeping, reading, texting, or engaging in disruptive activities during class is

equivalent to an absence and will be counted as such. Three absences are permitted and each absence beyond that, regardless of the reason, results in a 3-point deduction from the final course grade.

- *If you miss a quiz, you will receive a grade of zero on that quiz* (remember, you get to drop one quiz).

- *If you miss an exam, you will receive a grade of zero on that exam.* If you cannot attend class that day due to exceptional circumstances and I approve the absence, you may substitute your grade on the final for the missed exam. **You must be able to provide documentation regarding the reason for the absence.**

- *If you miss a lab, you will receive a grade of zero for that lab.* Lab make-ups may be permitted if the absence is due to exceptional circumstances and the missed work can be completed during another regularly scheduled lab period. Note that your lab write-up is still due at your assigned lab meeting time. If necessary, have someone deliver it to the lab for you.

Please keep in mind that absences due to doctor's appointments, work conflicts, or simply not feeling well (as opposed to being seriously ill) are not exceptional circumstances.

Additional resources: You can access course materials, such as answer keys and review session handouts, on the Moodle site for this course. If prompted for a password or key, enter *chemical*.

Copies of several organic chemistry texts are available in the reading room (217 Heim Bldg.). If you are not satisfied with McMurry's treatment of a topic, feel free to consult one of the other textbooks--you may just find one you like. These texts are excellent sources of extra practice problems (solutions manuals are available for several of the texts as well). There is an on-line text that some students have found quite useful:

www.cem.msu.edu/~reusch/vtxtindex.htm.

The "For Current Students" page from the Department of Chemistry web site includes links to syllabi, chemistry curriculum, faculty and student research, colloquium schedule, and other chemistry-related sites.

<http://www.lycoming.edu/chemistry/>

The on-line catalogs and databases are good sources of information for your lab reports. We'll talk more about them at the first lab meeting. You can access the Merck Index online through the ChemBiofinder site (now part of the Perkin Elmer Informatics site). This is more user-friendly than trying to access the Merck Index directly. Additional on-line resources are listed in the lab manual.

Aldrich Catalog www.sigmaaldrich.com ChemBiofinder chembiofinder.cambridgesoft.com

Extra Credit: You may earn extra credit by attending departmental colloquia (2 points per colloquium). If you cannot attend colloquia due to a class or work conflict, please see me to discuss other options, which are research- and writing-based assignments. Please be aware that all extra credit is due on the last day of class. Extra credit is capped at 10 points and is limited to half a letter grade (for example: from a B+ to an A-).

Colloquium attendance guidelines: Colloquium speakers may be your fellow students or visitors from other academic institutions or industry. The speakers have spent a lot of time and effort preparing for colloquium and deserve to be treated with respect. Arrive on time and stay until the end, including the question and answer period (plan on 45 minutes for an internal speaker, 60 minutes for a visitor). Please give the speaker your full attention.

Cell phones, Laptops, and other electronic devices are not permitted in class, in lab or at colloquium. If you have one with you, be sure it remains in your purse or backpack and is turned off. The presence and/or use of one of these devices during a quiz or exam will constitute an act of academic dishonesty.

Academic Integrity: Be aware that in accordance with the College's policy on academic honesty, any work you submit must be your own. Academic dishonesty includes, but is not limited to, *copying someone else's work on a quiz or an exam or lab write-up or allowing someone else to copy your work*. Any instances of academic dishonesty will be penalized to the fullest extent possible and reported to the Provost and Dean of the College.

Academic Support: If you have a learning disability and choose to request academic accommodations, please contact the Coordinator for Services for Students with Disabilities in the Academic Resource Center.

Course Schedule: While we may get a little ahead or behind the schedule in terms of the topics covered on any given day, the exam and quiz dates will remain the same. Reading and homework assignments are listed in the course supplement.

Date	Subject	Q/E
Week 1		
Aug. 25	Intro. to Organic, Atomic Structure	
Aug. 27	Lewis Structures, Bonding Theory	
Aug. 29	Hybridization	
Week 2		
Sept. 1	Drawing Structures, Formal Charge	
Sept. 3	Electronegativity, Polar Bonds, Non-Covalent Interactions	
Sept. 5	Functional Groups, Isomers	quiz (fri)
Week 3		
Sept. 8	Alkanes: Nomenclature, Properties, Conformations	
Sept. 10	Conformations of alkanes	
Sept. 12	Cycloalkanes: Properties, Nomenclature, Conformations	quiz (fri)
Week 4		
Sept. 15	Cyclohexane Conformers	
Sept. 17	Organic Reactions and Mechanisms	
Sept. 19	Polar Reactions, Arrow Notation	quiz (fri)
Week 5		
Sept. 22	Resonance	
Sept. 24	Resonance; MO theory	
Sept. 26	EXAM 1	EXAM
Week 6		
Sept. 29	Acid-Base Chemistry	
Oct. 1	Acid-Base Chem.; Kinetics and Thermodynamics	
Oct. 3	Alkenes: Structure, DU, and Nomenclature	
Week 7		
Oct. 6	Electrophilic Addition: Reaction with HX	
Oct. 8	Carbocation Reactivity and Rearrangements	quiz (wed)
Oct. 10	Electrophilic Addition of X ₂ to Alkenes	

Week 8

Oct. 13	Electrophilic Addition of H ₂ O to Alkenes	
Oct. 15	Other Addition Reactions of Alkenes	quiz (wed)
Oct. 17	Long Weekend - No Classes	

Week 9

Oct. 20	Alkynes: Structure, Properties and Nomenclature	
Oct. 22	Addition Reactions of Alkynes	
Oct. 24	EXAM 2	EXAM

Week 10

Oct. 27	Acid-Base Chemistry of Alkynes (last day to withdraw from full semester courses)	
Oct. 29	Multistep Synthesis	
Oct. 31	IR: Theory, Functional Group Absorptions	

Week 11

Nov. 3	IR: Functional Group Absorptions	
Nov. 5	IR Practice	
Nov. 7	Stereochemistry: Chirality, Assigning Absolute Configuration	quiz (fri)

Week 12

Nov. 10	Enantiomers, Diastereomers & Meso Compds	
Nov. 12	Stereochem. in Reactions; Atoms Other Than C	
Nov. 14	SN ₂ : Kinetics and Mechanism	quiz (fri)

Week 13

Nov. 17	SN ₂ : Leaving Group and Nucleophile	
Nov. 19	SN ₁	
Nov. 21	EXAM 3	EXAM

Week 14

Nov. 24	E1	
Nov. 26	No Classes - Thanksgiving	
Nov. 28	No Classes - Thanksgiving	

Week 15

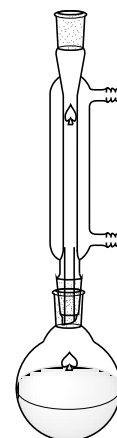
Dec. 1	E2: Kinetics and Mechanism	
Dec. 3	E2: Stereochemistry, Bulky Bases	quiz (wed)
Dec. 5	Acid Cat. Subst. & Elim.; Sn ₁ , Sn ₂ , E1 & E2 Summary	

Final Exam: Tuesday, December 9 at 8:30 am

CHEM 220 Laboratory – Fall 2014

The intent of the laboratory is to link the theory and practice of chemistry. In this lab, you will gain hands-on experience with many of the laboratory techniques and instruments that are central to the practice of organic chemistry. You will also be encouraged to THINK about what you are doing in the laboratory and how it relates back to the topics studied in class. To encourage this, we will begin most labs with a prelab meeting where we will highlight how the lab experiment connects to the class material. In the lab, I want to encourage you to *think about what you are doing and why you are doing it*, rather than “just going through the motions.” Many of the questions that you will see as part of your lab write-ups and on lab quizzes will also ask you to make the connection between theory and practice.

It is imperative that you come to the lab fully prepared. Careful preparation and planning before you arrive at the lab will allow you to complete your experiments in an efficient and safe manner. If you have read the lab ahead of time, the prelab discussion will be easier to follow as well.



The laboratory grade is worth a total of 110 points and is comprised of seven lab write-ups (70 points total), three lab quizzes (30 points), and a lab performance evaluation (10 points).

Lab Outline:

Week	Dates	Lab	Assigned Reading	Report due for:*
1	Aug. 26, 28	Check-in	Chp. 1, 2, 3	
2	Sep. 2, 4	Synthesis of isobutyl propanoate	Chp. 11, 15, 17	
3	Sep. 9, 11	Purification of isobutyl propanoate	Chp. 5, 14, 17	
4	Sep. 16, 18	Recrystallization of benzoic Acid and naphthalene	Chp. 8, 9, 10	Isobutyl propanoate
5	Sep. 23, 25	Solubility Testing	Chp. 4, 8, 9, 10	
6	Sep. 30, Oct 2	Extraction: Separation of a mixture	Chp. 11, 13	Quiz 1
7	Oct. 7, 9	Extraction: Separation of a mixture	Chp. 11, 13	Recryst. Part I
8	Oct. 14, 16	Extraction: Separation of a mixture	Chp. 11, 13	Recryst. Part II
9	Oct. 21, 23	Synthesis of benzil	Chp. 15, 18, 20	
10	Oct. 28, 30	Oxidation puzzle	Chp. 11, 12, 26, 28	Extraction, Quiz 2
11	Nov. 4, 6	Oxidation puzzle	Chp. 11, 12, 26, 28	Benzil
12	Nov. 11, 13	Limonene	Chp. 25, 27	Oxidation Puzzle
13	Nov. 18, 20	Limonene	Chp. 26, 27	
14	Nov. 25, 27	Thanksgiving--No Labs		
15	Dec. 2, 4	Check-out		Quiz 3 Limonene, due in class on 12/5

*Late reports will be penalized 5% per day. **Lab reports will not be accepted after graded labs are returned.**

Attendance: Attendance at lab is mandatory. Lab make-ups are permitted only for excused absences. For safety reasons, labs must be made-up during another regularly scheduled lab period.

Laboratory Reports: Lab write-ups are due before the start of prelab. Late write-ups are penalized 5% per day and are not accepted after graded labs have been returned in any lab section. **If you cannot attend your regularly scheduled lab section, be sure to have someone drop-off your lab write-up for you.**

Lab Safety and Hygiene: Lab safety is a priority and we will spend a significant portion of our first prelab discussing this topic. If you have questions regarding lab safety at any time throughout the semester, please ask. Because unsafe behavior by one person can jeopardize the safety of another, unsafe behavior is not tolerated and repeated violations may result in dismissal from the lab.

Laboratory Performance: One of the goals of this course is to help you develop as a scientist and experimentalist. You will be encouraged to develop the skills needed for success in the lab, such as preparation for lab, laboratory technique, ability to work efficiently, safety and lab hygiene. Assessment of these skills will occur throughout the semester using the matrix below.

Lab Performance Matrix

	1 (poor)	2 (fair)	3 (good)	4 (outstanding)
Safety – Personal Attire	Must be frequently reminded to wear safety glasses, appropriate clothing or footwear. Brings food, drink, or personal electronic devices into lab.	Need occasional reminding about safety glasses or clothing/footwear. Does not bring food, drink or personal electronic devices into lab.	Consistently wears safety glasses. Wears appropriate clothing and footwear. Does not bring food, drink, or personal electronic devices into lab.	Consistently wears safety glasses and appropriate attire. Does not bring food, drink or personal electronic devices into lab. Never needs to be reminded of policy. Helps others follow safety rules.
Safety – Work Area and Hygiene	Spills are not cleaned-up right away. Bench or hood is left in poor condition on multiple occasions.	Bench and fume hood are not always left in good condition.	Keeps a clean, uncluttered work area. Bench and fume hood are cleaned at end of lab. Shared space (ie. reagent hood) is clean.	During lab, work area is clean, organized, and without clutter. Bench and fume hood are thoroughly cleaned and organized at end of lab. Checks shared space to ensure it is clean.
Lab Equipment and Chemicals	Improper disposal of chemicals on multiple occasions. Frequently fails to store equipment properly at end of lab. Leaves lids off reagents bottles.	Improper disposal of chemicals. May occasionally fail to store equipment properly at end of lab. Lids occasionally left off reagent bottles.	Personal and shared equipment stored properly at end of lab. Lids kept on reagent bottles. Chemicals are disposed of properly.	Personal and shared equipment stored properly. Lids kept on reagent bottles. Chemicals are disposed of properly. Helps to ensure that others are handling chemicals, equipment and waste properly.
Preparation and Efficiency	Misses prelab or is significantly late on multiple occasions. Or, uses lab time poorly.	Is late to prelab on more than one occasion or does not work efficiently in lab.	Arrives on time or has been slightly late on one occasion. Works efficiently in lab.	Arrives on time. Works efficiently in lab. Uses “downtime” effectively (such as to prepare for later parts of the experiment).
Laboratory Technique	Completes experiments with little attention to technique. Careless or abusive with instruments/ equipment.	Basic proficiency at lab techniques. Or, not careful with equipment and/or instruments.	Careful execution of lab techniques. Handles equipment, instruments and chemicals with care.	Careful and skilled execution of lab techniques. Handles equipment, instruments and chemicals with care.