Fall Semester 2010

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<th>Lectures:</th>
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<tr>
<td>Monday, Wednesday and Friday</td>
<td>2:30 – 3:20 pm in 102 Forum</td>
<td>Monday, Wednesday and Friday</td>
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<tr>
<td>Lecturer:</td>
<td>Dr. Pshemak Maslak</td>
<td>Dr. Katherine Masters</td>
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<tr>
<td>Office</td>
<td>228 Chemistry Bldg</td>
<td>218 Whitmore Lab</td>
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<td>E-mail</td>
<td><a href="mailto:pm@chem.psu.edu">pm@chem.psu.edu</a></td>
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Office Hours: by appointment (request appointments by e-mail, specifying the issue to be addressed and listing dates/times when you are available)

Texts:

Other Materials:
- Web site: http://courses.chem.psu.edu/chem210
- ANGEL (lecture notes, handouts, quizzes, and the discussion forum)
- A molecular model kit is required, and we strongly recommend that it be used frequently
- Three other good texts have been placed on the reserve shelf in the Physical Science Library (230 Davey) for use if you want to read alternate accounts of the course materials (some older organic chemistry textbooks are also available in 211 Whitmore):

Course Objectives

The objective of the course is for students to develop an understanding and appreciation of both structure and chemical transformations of organic molecules. Students will acquire basic concepts of electronic structure and be able to apply them to solve problems from various areas of organic chemistry, including stereochemistry, reactivity patterns and synthesis. Improvements in learning strategies, critical-thinking, and problem-solving skills are an expected outcome.

Teaching Assistants

Graduate teaching assistants (TAs) are assigned specifically to this course. TAs will hold extensive office hours Monday – Friday. The time schedules are posted in 211 Whitmore, and on our website. TAs will also run review sessions before exams.
**Tutorial Room**

Capable undergraduate students are available to assist Chemistry 210 students in the Chemistry Department Tutorial Room (211 Whitmore Lab) after the first few days of classes. The hours are 6:30 - 10:30 p.m., Sundays through Thursdays.

**Grades**

Students’ grades are based only on the following criteria:
- Three comprehensive mid-term exams, 25% each
- Comprehensive final exam, 25%

Final grades are based on a “curve”. Periodically throughout the course, students will receive some feedback as to how their numerical scores might translate into class grades. These indications should be treated as rough estimates of final grades. After the third exam and before the late-drop deadline of April 8, 2011, the guaranteed maximum grade-line cutoffs (GGLs) for the letter grades will be provided to facilitate your planning for the rest of the semester. The +/- grade-lines will be available only after the final exam. Grade-lines have to be drawn somewhere, and it is inevitable and unavoidable that some students are just "a point" away from the higher grade. For the reason of fairness, the policy in this course is to NOT adjust individual grades in such circumstances.

Past experience indicates that the average scores on the exams vary from 70-55%. The four-exam average for the class is usually around 65%. The overall class average corresponds to C+/B– grade. About 20% of the class receives A’s (A, A–, with scores above 77%), and about 6% fail the course (i.e. receive F’s with scores below 45%). These estimates do not include students who drop the course or withdraw for various reasons. This information is based on the results from the last few years, and should not be considered as any kind of a guarantee. It is provided only to help you evaluate your own efforts and scores in the course.

**Exams**

- 1st exam: Monday, 2/7/2011, 8:15 -10:15 p.m.
- 2nd exam: Monday, 2/28/2011, 8:15 -10:15 p.m.
- 3rd exam: Monday, 4/4/2011, 8:15 -10:15 p.m.
- Make-up exam: Wednesday, 4/20/2011, 6:15 - 8:15 p.m.
- Final exam: as scheduled by the University Registrar

The exam locations are posted on our website. Only students with valid excuses are permitted to take the make-up exam. Only one comprehensive make-up exam is given. Conflicts in scheduling should be resolved in advance. The procedures for taking conflict or make-up exams are described below (under Procedures).

All exams are comprehensive multiple-choice tests (but the midterms concentrate on the material covered since the previous test). They are constructed in such a way as to emphasize active understanding of the material. Practice exams are provided on the web. To take the exam you will need writing implements (pencils) and your student I.D. card. You cannot use books, scratch paper (other than furnished), calculators, etc. You may, however, use a molecular model kit (it may not contain any written materials).

No electronic devices (except for simple watches) are permitted on the exams. If such devices are detected (whether in use or not) students may receive a zero score on the exam in question. An exception to this rule for medical (or otherwise essential) equipment must be arranged before the exam.

Answer keys for the multiple-choice exams are posted on the web (under "News and Updates") immediately after the exam. The exam scores are e-mailed to students by the University Testing Services and posted on ANGEL.
Problems

Working the in-chapter and back-chapter problems is one of the best methods to learn the material and the first step in preparation for the exams. It is anticipated that students will be able to solve all of the problems. The problems that help to develop the necessary basic skills (the early problems in each set) and those that are particularly indicative of what to expect on the exams are listed at the end of the syllabus as "Assigned Problems". These problems from the book are not collected or graded.

Additional problems in the form of multiple-choice questions are posted on ANGEL after each lecture (excluding pre-exam Q&A lectures). These on-line quizzes should be attempted after studying the material covered by the lecture and after solving the book problems. The quizzes are designed to help you develop daily studying habits and to check your progress. There is no credit earned by working on these questions. The quizzes are the second step in exam preparation.

The Testing Center on our website contains supplementary problems in the form of training sets and practice exams. This material should be used extensively for practice and self-evaluations during the last two weeks before the exams. Working on these sets of problems constitute the third and final step in exam preparation.

More detailed instructions on how to study and prepare for the exams are contained in Tutorials on our website. These recommendations are based in part on feedback from students who have successfully finished the course in the last few years.

ANGEL Materials

Copies of transparencies and slides shown during lectures are available on ANGEL. Printed copies should be brought to class as they provide a framework for organizing lecture notes. Taking detailed and well-organized lecture notes helps in studying and reviewing the material. Both sections use the same set of notes.

On-line quizzes are offered after all lectures (except for Q&A sessions just before the exams). More information on these quizzes is provided in the section above (under Problems).

Organic Discussions is the web forum where students may ask questions about the covered material, assigned problems, practice exams, etc., and to participate in discussion on organic chemistry topics. Most of the questions are answered within hours by the instructors or the course TAs who also monitor the forum to correct any factual errors or misstatements. To encourage participation, all postings are anonymous.

Chem 210 Web Site

The web site (http://courses.chem.psu.edu/chem210) is under constant development. It contains material on bonding (Quantum Primer) and visualizations of orbitals and molecules (Molecular Gallery), as well as the list of reactions covered in the lectures. There is a collection of very useful old exams (Testing Center), exam schedules, and general information on how to get help and how to study.

We also provide lecture-day announcements and summaries (News and Updates). Specifically, you will find links to web materials related to the lectures, some additional assignments and problems, as well as exam information. You should check the "News" on a regular basis: you may not claim ignorance as an excuse.
Procedures

To facilitate the smooth administration of the course, even when the unexpected happens, please abide by the following rules:

- **Contact points:** You are encouraged to discuss chemistry and/or the course with your instructor and TAs (see "Help" on the web for details). Simple non-chemistry questions or comments can also be sent via electronic mail. For administrative questions (registration, conflict and make-up exams, exam scores, lost-and-found, etc.) contact Mike Joyce in 210 Whitmore (preferred hours 9:00–11:00 a.m. and 2:00–4:00 p.m.). Chemistry questions should be posted to our Organic Discussions forum on ANGEL.

- **Conflict exams** are provided on the same day as the scheduled exams, but at different times. Students with valid conflicts (for example, University scheduled activities) must sign up for the alternative time with Mike Joyce (210 Whitmore) or by using the ANGEL form at least four working days before the exam. For students traveling with PSU instructors or coaches there is an option to take the exam "on-the-road", if the arrangements are made with Mike Joyce at least one week before the exam. Any final-exam conflicts are resolved through the Registrar.

- **The make-up exam** is given only to students with valid excuses (PSU-sanctioned activity, family emergency, illness, etc.). In order to be permitted to take the make-up exam you must provide Mike Joyce (210 Whitmore) with a written explanation of your absence within 2 weeks of the missed exam. This explanation should not include any unnecessary private details. Only one comprehensive make-up exam will be given on April 20, 2011. All students permitted to take this exam must sign up with Mike Joyce one week before the exam. Please note that once a regularly-scheduled exam is taken, no excuse can be used to request the make up exam in order to substitute for the score of that exam.

- **Late-drop students** receive WN designations on their transcripts.

- **A deferred-grade** is granted only under special circumstances when, for reasons beyond student's control, the student is prevented from completing a course within the prescribed time. Students with deferred grades must take a comprehensive final exam before the University-set deadlines. The deferred grade is based on the average of the scores obtained on all exams taken by the student, with the score of the deferred final exam substituting individually for all missed scores.

General Considerations

Chemistry 210 is a difficult course. It covers a lot of demanding material. Observations made over the past few years suggest some generally useful strategies that help to improve student performance. These strategies are summarized below, and a more extensive discussion is provided on our website:

- read the chapter material before the lecture
- study everyday, do reviews weekly
- solve as many end-of-chapter problems as possible (resort to the answer book only after you have attempted the problem) and take the on-line quizzes in a timely manner
- study with a friend; if you can explain a concept to your study mate, you understand it
- just reading and understanding the material (passive learning) is insufficient; you should be able to use the just learned concepts in situations not previously encountered, and make logical connections with concepts learned previously (active understanding)
- constantly probe your understanding by asking (and answering) question "why?" in relation to all statements and logical constructions
- do not fall behind in your study; it is virtually impossible to prepare for the exams by cramming
Academic Integrity

Instructors are now asked (Senate Rule 49-20) to provide at the beginning of a course a statement to "clarify the application of academic integrity criteria to that course". The Senate Rule includes the following:

Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabrication of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.

You should also be aware of the extensive parts of this Rule that describe procedures for handling alleged instances of academic dishonesty. Specific instances of academic dishonesty in this course would include (but are not limited to) copying or helping someone else copy during an examination, using unauthorized materials during an examination, stealing or destroying course materials or another student's examination paper, altering answers or grades on graded examinations, having someone take an examination for you, providing false excuse for missed exams, and attempting to do any of the above. Such infractions are considered cause, at the least, for awarding a grade of "0" on the exam in question, and not allowing the student to drop the class. For detailed procedures, see ECoS academic integrity web site.
Chemistry 210: Outlines of Lectures

1. Structure, Bonding & Molecular Properties (6 lectures*)
   - Structure of atoms, atomic orbitals
   - Chemical Bonding (ionic bonds, covalent bonds)
   - Valence-bond theory (hybridization)
   - Molecular Orbital (MO) theory (HOMO and LUMO)
   - Resonance
   - Electronegativity, dipole moments
   - Acids and bases

Sections covered: 1.1 - 1.12, 2.1 - 2.13, 14.1 (MOs of butadiene), 15.2 (MOs of benzene)
Sections specifically excluded: none
Assigned problems: 1.25, 1.26, 1.28, 1.30, 1.31, 1.32, 1.33, 1.35, 1.36, 1.44, 1.46, 1.47, 1.49, 1.50, 1.51, 1.52, 1.53, 1.54, 1.55, 2.21, 2.25, 2.26, 2.27, 2.30, 2.32, 2.33, 2.34, 2.35, 2.37, 2.38, 2.40, 2.41, 2.43, 2.45, 2.46, 2.51, 2.53, 2.54, 2.55, 2.56, 2.58

2. Alkanes (4 lectures*)
   - Alkanes as building blocks (isomers)
   - Functional groups
   - Nomenclature
   - Conformational analysis of alkanes and cycloalkanes (strain)

Sections covered: 3.1 - 3.7, 4.1 - 4.9
Sections specifically excluded: none

Exam I

3. Stereochemistry (3 lectures*)
   - Optical activity - enantiomers
   - Diastereomers
   - Absolute configuration

Sections covered: 9.1 - 9.9, 9.12, 9.14,
Sections specifically excluded: 9.10 - 9.11 (stereochemistry of reactions will be covered later, see below), 9.13

4. Organic Reaction Mechanisms (3 lectures*)
   - Thermodynamics, kinetics, energy diagrams
   - Writing reaction mechanisms
   - Radical chlorination of methane
   - Nucleophilic substitution on methyl halides
   - Addition of HBr to ethylene

Sections covered: 5.1 - 5.11, 9.10 - 9.11, 10.9
Sections specifically excluded: none
Assigned problems: 5.17, 5.20, 5.21, 5.22, 5.24, 5.26, 5.27, 5.29, 5.30, 5.31, 5.32, 5.33, 5.34, 5.35, 5.36, 5.38, 5.39, 9.74, 9.80, 10.19, 10.24, 10.25, 10.31, 10.32
5. **Electrophilic Addition of HX to π Bonds** (3 lectures*)
   - Cis-trans (E, Z) isomerism and degrees of unsaturation
   - Hyperconjugation and regioselectivity (Markovnikov's rule)
   - Hammond postulate
   - Addition of HX to π bonds in alkenes, alkynes and dienes
   - Carbocations and their rearrangements

   Sections covered: 6.1 - 6.11, 8.3, 9.10 - 9.11, 14.2

   Sections specifically excluded: none


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6. **Alkenes and Alkynes** (4 lectures*)
   - Addition of halogens and water
   - Reductions (mechanisms excluded) and oxidation, including hydroxylation and oxidative cleavage
   - Acetylide anions and organic synthesis

   Sections covered: 7.1 - 7.5, 7.7 - 7.9, 8.1 - 8.9, 9.10-9.11, 14.2

   Sections specifically excluded: 7.6, 7.10-7.11

   Assigned problems: 7.24 (except e), 7.25 (except f), 7.27 (except c), 7.28, 7.29, 7.30, 7.31, 7.33, 7.34, 7.37, 7.41, 7.42, 7.49, 7.52, 7.54, 7.55, 7.57, 7.60, 8.19, 8.21, 8.23, 8.25, 8.26, 8.28, 8.29, 8.31, 8.33, 8.34a, 8.36, 8.38, 8.42, 8.45 (error in the Solution Manual: bromonium ion is not an intermediate), 8.46, 8.47, 9.59, 9.60, 9.61, 9.62, 9.65, 9.66, 9.67, 9.81, 9.82, 14.21 (except e)

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7. **Conjugated Dienes** (2 lectures*)
   - Electrophilic additions
   - Kinetic vs. thermodynamic control
   - UV and visible spectroscopy. Chemistry of vision

   Sections covered: 14.1 - 14.3, 14.7 - 14.9

   Sections specifically excluded: 14.4 - 14.6 (to be covered in Chem 212)


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8. **Alkyl Halides** (1 lecture*)
   - Radical halogenation (reactivity vs. selectivity)
   - Allylic bromination

   Sections covered: 10.1 - 10.6

   Sections specifically excluded: 10.8 (sections 10.9 is covered earlier, section 10.7 is covered under alcohols)

   Assigned problems: 10.18, 10.20, 10.21, 10.23a-d, 10.27, 10.28, 10.37, 10.38

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9. **Aromaticity** (2 lectures*)
   - Hückel rule
   - Selected heterocycles, polycyclic aromatics

   Sections covered: 15.1 - 15.7

   Sections specifically excluded: 15.8 (it will be covered in Chem 212)

   Assigned problems: 15.17, 15.19, 15.20, 15.23 (consider substitution on the aromatic ring only), 15.25, 15.26, 15.27, 15.30, 15.31, 15.32, 15.33, 15.34, 15.35, 15.36, 15.37, 15.40

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Exam III
10. Nucleophilic Substitutions and Eliminations (3 lectures*)
- $S_N1$ and $S_N2$
- E1 and E2
- Effects of solvent, substrate structure, and nucleophile (base) on reactivity

Sections covered: 11.2 - 11.5, 11.7 - 11.10
Sections specifically excluded: 11.1, 11.6, 11.11

11. Electrophilic Aromatic Substitution (3 lectures*)
- Halogenation, nitration, sulphonation, alkylation, acylation
- Reactivity of aromatic rings (substituent effect)
- Oxidations, reductions of aromatic compounds and reactions of side-chain functional groups

Sections covered: 16.1 - 16.6, 16.9 - 16.11
Sections specifically excluded: 16.7, 16.8

12. Alcohols (2 lectures*)
- Hydrogen bonding, acidity, basicity
- Preparation of alcohols
- Reactions of alcohols

Sections covered: 17.1 - 17.7, also 10.7
Sections specifically excluded: 17.8 - 17.11
Assigned problems: 10.36, 17.31, 17.33, 17.36, 17.37, 17.40, 17.52, 17.55, 17.57, 17.68

13. Ethers and Epoxides (1 lecture*)
- Williamson synthesis
- Cyclic ethers
- Reactions of ethers and epoxides

Sections covered: 18.1 - 18.3, 18.5 - 18.6
Sections specifically excluded: 18.4, 18.7 - 18.9

Exam IV

* The number of lectures is approximate; adjustments may be made as necessary.