CHE 171: Mechanistic Organic Chemistry I

Syllabus, Autumn Quarter 2003

Instructor:
Dr. Matthew R. Dintzner
Office hours: Mondays 9:00-11:30 AM, Tuesdays 10:00-12:30, or by appointment
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Course Description:

CHE 171 is the first in a sequence of lecture/laboratory courses designed to investigate what organic chemistry is and how it works, by emphasizing the relationship between structure and function of organic molecules. Our primary objective for CHE 171 is to become proficient with the language and fundamental concepts of organic chemistry. Specific objectives and expectations will be posted on the web site by Friday before each weekly quiz. Everything about this subject is comprehensive, and so it is very important that you do not fall behind with the material. Unlike for other courses, it is impossible to "cram" for organic chemistry at the end of the quarter. The best strategy for success in this course is to stay on top of the material. The schedule is outlined below and we will stick to this as closely as possible. Please read the assigned sections of the texts before you come to class or lab.

Weekly Routine: (Lectures and Quizzes are in SAC 154; Labs are in O'Connell 460)

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00-11:30 *Office hours*	**10:00-12:30** *Office hours*			
12:00-12:30 *Quiz*		**12:00-1:00** *Lecture*	**11:50-12:50** *Lecture*	**12:00-1:00** *Lecture*
12:30-1:00 *Pre-lab lecture*				
1:00-5:00 *section 101 lab*	**1:00-5:00** *section 102 lab*	**1:00-5:00** *section 103 lab*	**1:00-5:00** *section 104 lab*	**1:00-5:00** *section 105 lab*
5:30-9:30 *section 106 lab*				

Texts:

- *Organic Chemistry 5th ed* .by F. A. Carey (ISBN 0-07-242458-3, required)
- Molecular Model Kit (required)
- *Organic Chemistry Solutions Manual* (optional, a copy will be on reserve in the library)
- *Multiscale Operational Organic Chemistry* by J. W. Lehman (ISBN 0-13-015495-4, required for lab)
- Also required for lab: spiral-bound "Student Laboratory Notebook" with carbonless NCR paper (ISBN 1-930882-74-2) and enclosed safety goggles.

All of the above are available in the Lincoln Park University Bookstore.

Grades: Final grades will be based on a point system, with 890 points as the maximum possible. Letter grades will be assigned according to the grading scale shown below:

Homework Problem Sets (3 pts each)…	30 pts
Weekly Quizzes (50 pts each, 1 drop)…	350 pts
Mid-term Exam…	100 pts
Final Exam…	200 pts
Lab Reports (25 pts each, w/ 2 drops)…	150 pts
Lab Quizzes (2 pts for safety quiz, 1 pt each for the rest)…	10 pts
Lab Notebook (carbonless duplicate sheets handed in after each lab)…	25 pts
Lab Final Exam…	25 pts

Grading Scale:
890-800, A-range
799-700, B-range
699-600, C-range
599-500, D-range
<500, F

Homework Problem Sets: There will be 10 problem sets (one per week) posted on the web-site on Wednesdays and to be handed in by the following Monday, prior to taking the quiz. For each problem in the problem sets I will suggest related practice problems from the book to try (but not to hand in). It is in your best interest to work out as many problems that are suggested from the book before attempting the problems in the problem sets. THE BEST WAY TO LEARN ORGANIC CHEMISTRY IS BY WORKING ON PROBLEMS, SO THE MORE YOU TRY, THE EASIER IT WILL GET!! The problem sets will be evaluated on a "check system" (√+ = 3 pts for excellent effort, √ = 2 pts for good effort, √- = 1 pt for minimal effort; 0 points for not handing in the problem set on time or at all) and be worth a maximum of 30 points total toward your final grade for the course. Problem sets are meant to help you learn the material and prepare for weekly quizzes and other exams.

Quizzes and Exams: There will be one 50-point quiz per week (except for the week of 10/13, when there will be a midterm exam instead), given during the first half-hour of class on Mondays (the second half of Monday classes will be used for pre-lab lectures). I will drop your lowest quiz grade. There will be a mid-term exam on Monday, 10/13, which will take the place of the weekly quiz; you will be given the full hour of class to complete the exam and it will be worth 100 points (equal to 2 quizzes). There will be a final exam for the lecture portion of the course that will be given on Tuesday, 11/25 (11:45 a.m. - 2:00 p.m.), worth 200 points (equal to 4 quizzes). There will also be a written final exam for the laboratory portion of the course, worth 25 points (given after the quiz on Monday, 11/10). Weekly 1-point lab quizzes will be given before each lab.

Schedule: (subject to change, as necessary)

DATE	READING	TOPICS	✓
W 9/10	Carey 1.1-1.4	Introduction &syllabus. Atoms, electrons, orbitals, ionic & covalent bonds, the octet rule.	
TH 9/11	Carey 1.5-1.7	Electronegativity, formal charge, structural formulas, Lewis dot structures	
F 9/12	Carey 1.8-1.11	Constitutional isomers, resonance, VSEPR theory, molecular dipole moments.	
M 9/15	**QUIZ 1**	PRE-LAB FOR LAB 1*	
W 9/17	Carey 1.12-1.18	Acid-base chemistry, pKa.	
TH 9/18	Carey 2.1-2.6	MO & VB theories, ground-state electronic configuration of C, begin hybridization (sp^3).	
F 9/19	2.20-2.22	Continue hybridization (sp^2, sp)	
M 9/22	**QUIZ 2**	PRE-LAB FOR LAB 2	
W 9/24	2.8-2.12	Intro to hydrocarbons, alkanes, IUPAC nomenclature.	
TH 9/25	2.13-2.16	Alkyl groups, cycloalkanes.	
F 9/26	2.17-2.19	Physical and chemical properties of alkanes, oxidation-reduction	
M 9/29	**QUIZ 3**	PRE-LAB FOR LAB 3	
W 10/1	Carey 3.1-3.4	Conformational analysis of straight chain alkanes.	
TH 10/2	Carey 3.5-3.8	Conformational analysis of small rings and cyclohexanes	
F 10/3	Carey 3.9-3.14	Cyclohexane continued and other ring	

		systems	
M 10/6	**QUIZ 4**	PRE-LAB FOR LAB 4	
W 10/8	Carey 4.1-4.6	Functional groups, alcohols and alkyl halides, nomenclature and physical properties.	
TH 10/9	Carey 4.7-4.12	Substitution reactions (S_N1, S_N2), carbocations, energy diagrams of reactions.	
F 10/10	Carey 4.13-4.19	Free radical reactions of alkanes.	
M 10/13	**MID-TERM EXAM**		
W 10/15	Carey 5.1-5.7	Alkenes: nomenclature, E-Z stereoisomers, physical properties, cycloalkenes	
TH 10/16	Carey 5.8-5.12	Elimination reactions, dehydration, E2 and E1 mechanisms, Hoffmann vs. Zaitsev's rule.	
F 10/17	Carey 5.13-5.18	Carbocation rearrangements, dehydrohalogenation.	
M 10/20	**QUIZ 5**	PRE-LAB FOR LAB 6	
W 10/22	Carey 6.1-6.7	Hydrogenation of alkenes, electrophilic addition, Markovnikov's rule, carbocation rearrangements.	
TH 10/23	Carey 6.8-6.17	Free radical reactions with alkenes, hydrolysis of alkenes, acid-catalyzed hydration of alkenes, hydroboration-oxidation, halogenation, halohydrins.	
F 10/24	Carey 6.18-6.22	Epoxidation, ozonolysis, introduction to organic synthesis.	
M 10/27	**QUIZ 6**	PRE-LAB FOR LAB 7	
W 10/29	Carey 7.1-7.4	Enantiomers, chiral centers, symmetry, optical activity.	
TH 10/30	Carey 7.5-7.8	Absolute and relative configuration, Cahn-Ingold-Prelog convention, Fischer projections, properties of enantiomers.	
F 110/31	Carey 7.9-7.14	Stereochemical considerations for reactions, diastereomers.	
M 11/3	**QUIZ 7**	PRE-LAB FOR LAB 8	
W 11/5	Carey 8.1-8.4	Nucleophilic sbustitution: S_N2 mechanism and stereochemistry.	
TH 11/6	Carey 8.5-8.7	Steric effects, nucleophiles and nucleophilicity.	

F 11/7	Carey 8.8-8.11	Nucleophilic Substitution: S_N1, carbocations, stereochemistry, carbocation rearrangements.	
M 11/10	**QUIZ 8**	**LAB FINAL EXAM**	
W 11/12	Carey 8.12	Solvent effects on reaction rates.	
TH 11/13	Carey 8.13-8.14	Substitution vs. elimination, sulfonate ester substrates.	
F 11/14	Carey 8.15	Review and overview of substitution reactions.	
M 11/17	Carey 9.1-9.14	Alkynes	
11/25	**FINAL EXAM** **11:45 AM - 2:00 PM**		

*See Lab Schedule below.

Lab Schedule:

WEEK OF:	TECHNIQUE (READING ASSIGNMENT)	EXPERIMENT	√
9/10	(Lehman Introduction, p. 1-18)	Check-in, attend Safety Lecture (see schedule below‡)	
9/15	Basic Operations (Lehman p. 20-27, and OP 1,4,5,6,13 &23)	**Lab #1**: The Effect of pH on a Food Preservative (parts A and B, standard scale)	
9/22	Extraction and Evaporation (Lehman p. 28-34, and OP 7,12,13-16)	**Lab #2**: Separating the Components of "Panacetin" (standard scale)	
9/29	Recrystallization and Melting-Point Measurement (Lehman p. 35-39, and OP 25 &30	**Lab #3**: Identifying a Component of "Panacetin" (standard scale)	
10/6	TLC (hand-out), Column Chromatography, and UV-VIS spectrometry (Lehman p. 78-86, and OP 15c, 18, 19 & 38)	**Lab #4**: Isolation and Isomerization of Lycopene from Tomato Paste (microscale)	
10/13	Simple Distillation, Gas Chromatography (Lehman p. 49-57, and OP 10,21,22,27 & 34)	**Lab #5**: Preparation of Synthetic Banana Oil (standard scale)	
10/20	Fractional Distillation (Lehman p. 58-64, and OP 29)	**Lab #6**: Separation of Petroleum Hydrocarbons (microscale)	
10/27	(A) Boiling Point (Lehman p. 72-	**Lab #7**:	

	77, and OP 31) (B) Vacuum Distillation, Optical Rotation (Lehman p. 101-106, and OP 28 & 33)	(A) Identification of a Petroleum Hydrocarbon (Purification and BP Determination, and Density Measurement) (B) Measuring the Optical Activity of α-Pinene (microscale)	
11/3	Steam Distillation, IR Spectrometry (Lehman p. 87-93, and OP 17 & 36)	**Lab #8**: Isolation and Identification of the Major Constituent of Clove Oil	

‡**Laboratory Safety Lecture Presentations:** You must attend one of the following and take a quiz at the end (worth 2 pts toward your final grade).

DAY	TIME	LOCATION
Wednesday (9/10)	1:15-2:15 p.m.	McGowan 201
Thursday (9/11)	1:00-2:00 p.m.	SAC 154
Tuesday (9/16)	11:50-12:50 p.m.	SAC 161
"	2:00-3:00 p.m.	O'Connell 330
Wednesday (9/17)	3:30-4:30 p.m.	Student Center 314A
Thursday (9/18)	8:00-9:00 a.m.	Student Center 312
"	11:50-12:50 p.m.	SAC 254
Friday (9/19)	4:00-5:00 p.m.	Student Center 312
Wednesday (9/24)	3:00-4:00 p.m.	Student Center 314B

Academic dishonesty: Any violation of the academic honesty policy in the classroom is extremely serious. Read the appropriate sections of the Student Handbook for the policy.