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ORGANIC CHEMISTRY I (CH 323)
COURSE OUTLINE
FALL SEMESTER 1999

Bülent Terem

Required Textbook: Brown, W.H. *Organic Chemistry*, Saunders College Publishing, 1995.

Supplementary Books:

Iverson, B.L. and Iverson, *S.A. Student Guide and Problems Book for Organic Chemistry by William H. Brown, Vol.* 1, Saunders College Publishing, 1995.
Bruice, P.Y. *Organic Chemistry*, Prentice-Hall, Inc., 1995.

Software: ChemDraw (for Windows); Chem 3-D, Cambridge Soft Corp.

Supplementary Materials:

Molecular Models

Exams and Grading: Three 45-minute midterms, quizzes and homework assignments, and a ninety minute comprehensive final.

Course Grade (all grades in percentages)

+ .26 (average of the three midterms)
+ .26 (average of the two highest midterms)
+ .10 (average of the quizzes and assignments)
+38 (final)

Office Hours: TR 12:30 - 1:00 and/or by arrangement

Review Sessions: To be arranged

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General Comments:

The prescribed method for organic chemistry is "active learning", which means that students should think about and reformulate the concepts presented. This aspect will be emphasized during lecture periods and will be reenforced with appropriate assignments. Active learning will also require solving problems presented within each chapter of the textbook, as well as redoing the exams and quizzes already taken. The depth of organic chemistry is beyond that of a basic science; at times it can be perceived as a philosophy, or an art, or architectural design. It can also help to answer questions which start with "why?" In a liberal arts college with a student population from different backgrounds and with different career interests, the multi-dimensionality of this discipline can be demonstrated much more easily. It is hoped that at the end of the semester, the student will be fulfilled intellectually, in addition to accumulating the knowledge which is essential for his/her studies in molecular and/or biomedical sciences.

Week	Date	Chapter	Subject
1	8/31	1	Introduction to Organic Chemistry: Historical perspectives; Organic Chemistry in the hierarchy of other scientific disciplines... Electronic structure of atoms... Chemical bonding: Lewis model; Ionic, covalent, and polar covalent bonds... Lewis Structures; The Octet Rule; Formal Charges; Exception to the Octet Rule... VSEPR Model and shapes of molecules... Functional Groups...
1	9/2	1 2	Valence Bond Theory and Hybridization (Sections not covered yet: 1.6, 1.7, 1.9) Alkanes: Structures and Molecular Formulas... Constitutional isomerism... Nomenclature of alkanes: IUPAC naming; Common Names...
2	9/7		Classification of carbon and hydrogen atoms... Equivalent carbons and hydrogens... Free Rotation in alkanes...
2	9/9	2	Cycloalkanes: Structure and Nomenclature ...Bicyclic and Spiroalkanes Conformations of alkanes: Newman Projections and Saw-Horse Representations... Conformations of Cycloalkanes: Chair and Boat conformations of cyclohexanes... Strained c cloalkanes... Cis-Trans isomerism in c cloalkanes...
3	9/14	2 (1.9)	Physical properties of alkanes and cycloalkanes... Reactions of alkanes: Oxidation (complete combustion); Halogenation... Molecular Orbital Theory of bonding (1.9) and its implications to halo enation... Re ioselectivi of halo enation...
3	9/16	3	Acids and Bases: Arrhenius and Bronsted-Lowry definitions... Electron and proton transfer representations: Curly arrows... Measure of acid and base strength... Lewis acids and bases...
4	9/21	4 (1.6)	Alkenes: Nomenclature and orbital representations... Effects of π-bonds to chemical reactivity... C=O double bonds; electron delocalization and π-bonds; Resonance Theory 1.6 Cis-Trans isomerism in alkenes... Te ene hydrocarbons 4.6
4	9/23		FIRST MIDTERM EXAM
5	9/28	4 5	Preparation of alkenes: Dehydrohalogenation... Chemical Reactions: Mechanism and Energetics... Electrophilic addition reactions of alkenes: Acid catalyzed hydration; Formation of carbocations; Regioselectivity and carbocation stability...
5	9/30	5	Halogenation and stereoselectivity... Oxymercuration-Demercuration... Halohydrin formation... Hydroboration... Radical Halogenation... Allylic halogenation... A mechanistic look at the halogenation of alkanes (expanding 2.913)... Catalytic hydrogenation of alkenes... Heats of hydrogenation as a clue to comparisons of alkene stabili ...
6	10/5	5	Oxidation-reduction in organic chemistry... Oxidation of alkenes... Ozonolysis... Polymerization
6	10/7	6	Alkynes: Nomenclature and orbital representations... Preparation and reactions of alkynes: Catalytic hydrogenation; Halogenation; Hydroboration (keto-enol tautomerism ; Hydration... Acidity of terminal alk nes...
7	10/12	7	Conjugated Dienes: Orbital representations (wave mechanics revisited: Sect. 1.7).:. 1,2- and 1,4-additions; kinetic and thermodynamic considerations...
7	10/14	7 8	Diels-Alder Reactions... Chirality... A survey of isomerism... Tetrahedral molecules with stereogenic centers; Chirali without a stereo epic center...
8	10/19	8	Representation of chirality: 3-D drawings; Fischer Projection Formulas... Optical Activity... Racemic mixtures... R/S Configuration... Molecules with more than one stereocenters...
8	10/21	8	Diastereomers... Meso-compounds... Chirality and biological systems... The lock and key concept... Stereochemistry of electrophilic addition reactions: Stereoselective and stereos ecific reactions...
9	10/26		SECOND MIDTERM EXAM

9	10/28	9	Alcohols: Nomenclature and physical properties... Preparation of alcohols (review)... Reactions of alcohols: Reactions with active metals... Acidity and basicity of alcohols (comparisons with thiols)… Conversion of alcohols into alkyl halides... Dehydration of alcohols ...
10	11/2	9	Nucleophilic Substitution reactions... Carbocation Rearrangements: Pinacole-pinacolone rearrangement... Oxidation of alcohols... Enzymatic oxidation of alcohols... Oxidation of thiols…
10	11/4	10	Alkyl halides: Structure, nomenclature, and physical properties... Preparation of alkyl halides (review)... Mechanism, kinetics, and stereochemical features of nucleophilic substitution reactions: S_N1 and S_N2 reactions...
11	11/9	10	Factors influencing substitution reactions... An analysis of several substitution reactions... Solvent effects... β-Elimination reactions: El and E2 mechanisms...
11	11/11		No class: Veterans Day
12	11/16	10 I I	Stereoselectivity of E2 reactions... Ethers: Nomenclature and physical properties... Preparation of ethers: Williamson ether synthesis; Alkoxymercuration-demercuration; Acid catalyzed dehydration of alcohols…
12	11/18	11	Preparation of thiols and sulfides... Epoxides: Structure and chemical reactivity... Synthesis of epoxides: from alkenes; from halohydrins... Meting of epoxides: Acid catalyzed and base catalyzed ring opening reactions...
13	11/23	11	Betaines from epoxides… Crown ethers (host-guest complexing)
13	11/25		No class: Thanksgiving
14	11/30		THIRD MIDTERM EXAM
14	12/2	14 (in part) 12	A general look into spectroscopy: an organic chemist's perspective... Ultraviolet and visible spectroscopy (14.3)... Mass spectrometry... Instrumental features...
15	12/7	12	Analysis of mass spectra: Resolution; Isotopes; Molecular ion peaks...
15	12/9	12	Frag ntation in mass spectrometry
	12/15		FINAL EXAM (Wednesday; 08:00)