Course goals and objectives: This is an introductory course to organic chemistry. Particular attention will be given to the correlation of molecular properties with the physical properties of materials. Detailed mechanisms of several reactions will be covered. This course will provide the needed background for the more advanced Organic Chemistry courses CHEM 242 and CHEM 243.

Resources: Textbook: Solutions to problem sets from Wade (Organic Chemistry, Ed. 5) are available only to students registered in the class via WebCT.

Grading: 2 1.5-hour exams 2 x 100
final 200
total 400

Course Information: An FAQ for the class is maintained on this blog and is updated periodically. E-mail the instructor if your question is not addressed in the FAQ.

Make-up test policy: Tests, quizzes and exam will be available on WebCT. Location and times of testing are specified in the FAQ. Quizzes will be available for each chapter but will not count towards the final grade. Make-up tests will be available on WebCT but will consist of additional questions without additional time. The better score between the test and make-up will be used.

Lecture archives: This class can be taken fully online. The class archives are made available by screencasting as streaming audio/video as well as podcast by audio with pdfs to follow along. Students attending the class fully online are encouraged to contact the instructor by e-mail to ask questions or to schedule phone or physical appointments to go over any material that requires further explanation.
**Grading Policy:** A: 90-100% B: 80-89% C: 65-79% D: 50-64% F: 0-50% (borderline grades are left to the discretion of the professor)

**Extra Credit:** Up to 1% extra credit is available for students who create blogs discussing real world applications of the reactions we discuss in class. References must be used with at least 2 examples for full credit. Students may also use their blog to report on this class in general (i.e. study tips, difficulty of certain material, additional online resources found, etc.) Blogs can easily be created at www.blogger.com. Since blogs are public, students do not have to use their real names but can if they choose. A list of RSS feeds to the class blogs will be made available on this blog. The deadline for completion of the two examples is the last day of classes. However, students are encouraged to post as early as possible to make use of feedback from instructor. Revisions of the posts based on feedback from the instructor (or other students) is acceptable up to the last day of classes.

**Material Covered**

**Electronic Configuration**

Pauli Exclusion Principle:
- Only 2 electrons per orbital (opposite spin)
- Electrons like to be unpaired if possible

Types of bonds: covalent and ionic

**Valence Periodic Table**

**Solving Lewis Structures**

**Resonance Hybrids and curved arrow formalism**

**Lewis, skeletal and condensed structural formulas**
Molecular and empirical formulas

Acids and Bases
Lowry-Bronsted Acid: PROTONS (H+)
Lewis Base: Lone pair of electrons

Molecular Orbitals and Functional Groups

Atomic and Molecular Orbitals: the geometry of electron probability distribution
s, p, sp, sp2, sp3

Hybrid orbitals
sp = 2 groups of electrons = linear
sp2 = 3 groups of electrons = trigonal planar (120°)
sp3 = 4 groups of electrons = tetrahedral (109°)

Pi and Sigma bonds-the ethylene example

Rigidity of Double Bonds

Isomerism- structural isomers and stereoisomers (geometrical isomers)

Bond polarity and dipole moment
Molecule Polarity: sum of dipole moments

Intermolecular Forces
Dipole-Dipole interaction (e.g. CH3COCH3 acetone)
Hydrogen bonding (e.g. HF, H2O) NEED F, O or N and H
van der Waals forces (e.g. He, CH4)

Structure and physical properties
Melting point (higher for stronger intermolecular forces)
Boiling point (higher for stronger intermolecular forces)
Solubility (like dissolves like)
Alkanes, Alkenes, Alkynes, Alcohols, Ethers, Aldehydes and Ketones, Carboxylic Acids
Acid Chlorides, Esters, Amides, Amines

Hydrocarbons

Let’s count to 10: methane, ethane, propane, butane, pentane, hexane, heptane, octane, nonane, decane

Nomenclature: isopropyl, isobutyl, n-butyl, sec-butyl, t-butyl,

Primary, Secondary, Tertiary, Quaternary centers

Reactions of Alkanes
1) combustion
2) cracking
3) halogenation

Conformations of ethane, propane, butane
Newman projections
Steric Hindrance

Cycloalkanes
Cis-trans isomerism of cycloalkanes
Chair and boat configurations of cyclohexane
Axial and Equatorial positions

Problems:
(Edition 4) 33,34,42,44
(Edition 5) 33,34,42,44

Halogenation of alkanes
Bromination of methane
Bond Dissociation Energy
Homolysis and Heterolysis
Transistion State (Predicting the geometry using the Hammond Postulate)
Rate-limiting step

Bromination of propane
Chlorination of propane (loss of selectivity)
Free-radical stabilities

Carbocations/Carbanions

Chirality
R and S configurations
Optical activity: detrimentary and levoretatory
Specific rotation
Racemic mixture
Fisher Projection
Diastereomers and Enantiomers
Reactions involving chiral centers

Alkyl halides

Nomenclature
Preparation
1) Free-radical halogenation
2) Hydrohalogenation of alkenes
3) From alcohols
4) From other alkyl halides
Reactions
1) elimination
2) nuleophilic substitution

SN1 and SN2 reactions
Solvent effects on nucleophilicity
Walden inversion
Rearrangements in SN1 reactions (hydride and methyl shifts of carbocations)
E-1 and E-2 Reactions
Satyzeff Rule

Alkenes
Unsaturation
Nomenclature
Z and E, cis and trans
8 Carbon Rule

Preparation
1) Dehydrohalogenation
2) Dehalogenation
3) Dehydration of alcohols
4) Catalytic cracking of alkanes
5) Wittig synthesis

Reactions:

Electrophilic addition
Markovnikov’s rule
Anti-Markovnikov addition
Hydration of Alkenes
Anti-Markovnikov hydration by hydroboration
Catalytic hydrogenation
Simmons-Smith reaction
Halogenation
Hydrohalogenation
Epoxidation
Permanganate hydroxylation (cold, dilute)
Permanganate (warm, concentrated)
Ozonolysis
OsO₄
Carbenes

Alkynes

Nomenclature of alkynes
Acidity of alkynes
Preparation
From vicinal dihalides
From acetylides

Reactions
Hydrogenation
Partial hydrogenation (Lindlar’s catalyst)
Halogenation
Markovnikov addition of HBr
Hydration to ketones
Permanganate (cold, dilute)
Permanganate (warm, concentrated)