CAMOSUN COLLEGE
DEPT. OF CHEMISTRY & GEOSCIENCE
CHEMISTRY 230-Fall 2002

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Texts: "Organic Chemistry, Structure and Reactivity" Fourth Edition, by S. N. Ege
"Organic Chemistry Experiments for Chemistry 230 and 231" by R. Raap and N. Khalifa
*********Both texts are REQUIRED*****

Pre- or Corequisite: Chem121

Detailed Course Outline:

Chemical Bonding (Chapters 1, 2); Acid and Base Theory As It Relates To Organic Chemistry (Chapter 3); Alkanes and Cycloalkanes (Chapter 5)
*** No formal lectures are scheduled to cover these topics, a review problem set will be given)**
-Structural theory of organic chemistry, Lewis structures, Exceptions to the octet rule, formal charges, Atomic orbitals, molecular orbitals, Resonance, hybridization, Molecular geometry, polar and nonpolar molecules, Carbon-carbon covalent bonds, Aromaticity, Functional groups; classification of organic compounds into families, Organic reactions and mechanisms.
-Acid and base reactions, Homolysis and heterolysis of bonds to carbon, Use of curved arrows in reaction mechanisms, Carbocations and carboanions, The strength of acids and bases, K_a and pK_a
-Relationship between structure and acidity, Effect of the solvent on acidity, protic and aprotic solvents, Acids and bases in nonaqueous solutions
-IUPAC nomenclature, Physical properties of alkanes and cycloalkanes, Conformational analysis of butane, Ring strain in cycloalkanes, Conformations of cyclohexane, Substituted cyclohexanes, cis-trans isomerism, Bicyclic and polycyclic alkanes, Synthesis of alkanes and cycloalkanes, Reactions of alkanes

Stereochemistry and Chirality: (Chapter 6)
-Isomerism: constitutional isomers and stereoisomers
-Enantiomers and chiral molecules
-Nomenclature of enantiomers, the R-S system
-Optical activity
-Diastereomers, Fischer projection formulas
-Separation of enantiomers; resolution
-Compounds with stereocenters other than carbon

Nucleophilic Substitution and Elimination Reactions: (Chapters 4, 7)
-Organic halides, physical properties
-Nucleophilic sustitution reactions, nucleophiles, leaving groups
-Themodynamic and kinetic control of reactions
-Transition state theory, energy diagrams
-Mechanism for S_N2 reactions, stereochemistry
-Mechanism for S_N1 reactions, stereochemistry

-Factors affecting the rates of S_N1 and S_N2 reactions, solvent effects
-Elimination reactions of alkyl halides, the E2 and the E1 reactions
-Substitution versus elimination
-Functional group transformations using the S_N2 reaction

Spectroscopy: (Chapter 11)
-The electromagnetic spectrum
-Absorption spectra, transitions between electronic energy levels
-Ultraviolet spectroscopy, relationship between structure and λ_{max}
-Infrared spectroscopy, molecular vibrations and absorption frequencies,
-IR spectra of alcohols, aldehydes, ketones, carboxylic acids, esters, aromatic compounds
-Mass spectroscopy, molecular ions, fragmentation patterns, isotopes
-Use of UV/VIS, IR, and MS spectra to elucidate structures of organic compounds

Free Radical Reactions: (Chapter 21.1-21.5)
-Homolytic bond dissociation energies
-Reactions of alkanes with halogens
-Chlorination of methane, mechanism
-Halogenation of higher alkanes, geometry of alkyl radicals
-Radical polymerization

Alkenes and Alkynes: (Chapters 8, 9)
-Structure and nomenclature
-Physical properties: stability, boiling point, solubility
-Preparation of alkenes and alkynes
-Polar additions to the carbon-carbon multiple bond: ionic addition, carbocations, addition of halogens,
-Markovnikov's Rule **(Chapter 4.3)** , Anti-Markovnikov addition of HBr,
-hydration using mercuric acetate, hydroboration, addition of carbenes
-Catalytic hydrogenation: the catalyst, stereochemistry
-Oxidation of alkenes: conversion to diols, cleavage of the double bond
-Alkynes as acids, hydration of alkynes
-Reduction of alkynes
-Conjugated dienes: 1,2- and 1,4-additions, thermodymanic versus kinetic control **(Chapter 18.1-18.3)**
-The Diels-Alder reaction, stereochemistry **(Chapter 18.4)**
-Synthetic methodology and applications

Alcohols: (Chapter 12)
-Classification and nomenclature
-Physical properties: boiling points, solubility in water
-Preparation of alcohols: hydration of alkenes, oxymercuration and demercuration,
hydroboration of alkenes **(Chapter 8.4-8.6)**, nucleophilic substitution reactions **(Chapter 7)**
-Acidity and basicity of alcohols
-Reactions of alkoxide ions
-Mesylates and tosylates
-Concept of protecting groups, use in synthesis
-Substitution reactions of alcohols: reactivity of alcohols toward hydrogen halides, S_N1 vs S_N2

-Other reagents to convert alcohols to alkyl halides
-Elimination reactions of alcohols
-Oxidation reactions of alcohols, chromium (VI) reagents, potassium permanganate, selective oxidation

Ethers and Epoxides: (Chapter 12)
-Nomenclature of ethers and epoxides
-Physical properties of ethers and crown ethers
-Preparation of ethers: preparation of diethyl ether, Williamson ether synthesis, acid-catalysed Markovnikov addition to alkenes, cyclic ethers
-Preparation of epoxides
-Substitution reactions of ethers
-Substitution reactions of epoxides: mechanism of base-catalysed and acid-catalysed cleavage, anti-hydroxylation of alkenes via epoxides
-Synthetic applications

Chem. 230 Lab Schedule (Fall 2002)
(subject to change)

week of Sept. 3-6	no labs
week of Sept. 9-13	review problem set
week of Sept. 16-20	exp. 8, stereochemistry and models
week of Sept. 23-27	no labs. **Test # 1**
week of Sept.30-Oct. 4	exp. 1, melting point determination
week of Oct. 7-11	spectroscopy I
week of Oct. 15-18	spectroscopy II
week of Oct. 21-25	no labs. **Test # 2**
week of Oct. 28-Nov. 1	exp. 3, recrystallization and sublimation
week of Nov. 4-8	exp. 4, separation of a mixture
week of Nov. 12-15	no labs. **Test # 3**
week of Nov. 18-22	exp. 7, isolation of natural products
week of Nov. 25-29	exp. 9, relative rates of substitution reactions
week of Dec. 2-6	Lecture/Review

Grades:

A+ = 95-100%	B- = 70- 74
A = 90- 94	C+ = 65- 69
A- = 85- 89	C = 60- 64
B+ = 80- 84	D = 50- 59
B = 75- 79	F = < 50

Lab experiments	**30%**
Test 1 Wed. Sept. 25 or Thurs. Sept. 26 (2.5 hrs)	**10%**
Test 2 Wed. Oct. 23 or Thurs. Oct. 24 (2.5 hrs)	**10%**
Test 3 Wed. Nov. 13 or Thurs. Nov. 14 (2.5 hrs)	**10%**
Final Examination (Dec., 3 hrs)	**40%**

	100%

*Final exam at the end of the course will cover **all** course material
*At least a passing grade on lab marks must be achieved in order to write the final exam.
*You must pass both the lecture portion and the lab portion in order to pass the course.
*If you are unable to write one of the three tests (due to illness), the test grade will automatically be dropped and the weight transferred to the final exam.
*You must provide your own **safety glasses**. Prescription glasses are OK, but sunglasses are NOT. You must wear these safety glasses at all times while you are in the lab. You will not be allowed to carry out any experiments without safety glasses.
*Office hours are posted on the door. You can, however, bug me in the office any time. You will not be wasting my time if you come for help. I'm here to help you learn.

Organization Of The Lab Report

Title of the experiment: State the title of the experiment you have just carried out.

Date: Write the date on which you did the experiment.

Name: Your name and lab partner's name (if applicable)

Objective: State what you want to achieve by doing the experiment in one or two sentences. Be very brief and to the point.

Procedures: You can write the following: Please refer to Chem. 230/231 lab manual, 2002 Edition. pp. xx-xx. Record any changes to the given procedures.

Data: Organize any data, whether numerical or descriptive, in a **neat table** (or tables if applicable). Report such things as **unknown numbers**, **concentrations** of solutions, **masses** of reactants and products. Any relevant data recorded on a rough data sheet should be copied here. Do not forget to write **chemical equations** here.

Discussion and Calculations: In this part of the report, you will make sense out of the data you have obtained. If you obtain a product, calculate the **percentage yield**. Provide a physical description of your product. Show **all** the calculations you do, but there is no need to be repetitive. For example, if you perform 3 or 4 titrations using the same two solutions, then you only need to show the calculation for one trial. In cases where you have not obtained the results you were hoping for, provide a very brief explanation.

Conclusion: In no more than two sentences, state what you have achieved by doing the experiment.

Answers To Questions: In cases where questions are asked during or at end of experimental procedures, provide the answers here.

* Lab reports should be written in **ink, including all calculations**. The report does not have to be typed. If you are not using a computer to graph data, use graph paper. If your report does not follow the format given above, it may be deemed unacceptable and you may have to resubmit it. The new report will be considered late if it is not submitted on the same due date (see below).
* Lab reports are normally due one week after the assigned date for the experiment. You will be informed in advance if there are any changes to the due date.
* The report is marked out of 10. For every day the report is late, you lose 1 (one) mark.
* Make sure to **staple** the pages of your report together, including any **rough data sheets**. You lose 1 (one) mark if the pages of your report are not stapled together.