

CHEM 243 Organic Chemistry III.

SpringTerm 2006-2007

3 Credits, Lecture: M 6:00-8:50 PM; Rm. Stratton 113 Dr. Jeffrey Adams,
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Office Hours (Stratton 113) M 5:15-6:00 PM or by appointment.

Text: Organic Chemistry, L. G. Wade, 6th Edition

Exams: 2 exams (100 pts each) plus 3 unannounced quizzes (2 counted, 10 pts each). Before each exam a separate "review session" will be held to go over homework and practice problems and answer other questions. Chapter assignments (weekly) will be collected and reviewed. IT IS EXTREMELY IMPORTANT TO DO THE ASSIGNED PROBLEMS. Grades are curved and turning in homework can decide "borderline" grades. For the new +,- grading system, a **tentative** scale **may** be:

87-100 A+	72-74 B-	57-59 D
84-86 A	69-71 C+	54-56 D-
81-83 A-	66-68 C	<54 F
78-80 B+	63-65 C-	
75-77 B	60-62 D+	

Prerequisite: CHEM 242

Topics Covered:

Chapter 16: Aromatic Compounds.

History of benzene and aromatic compounds; Structure and properties of benzene; Molecular orbitals of benzene; Molecular orbitals of cyclobutadiene; Aromatic, antiaromatic and nonaromatic compounds; Hückel's Rule and annulenes; Aromatic ions; Heterocyclic aromatic compounds; Polynuclear aromatic compounds; Fused ring heterocyclic compounds; Nomenclature of benzene derivatives; Physical properties of benzene and its derivatives; Spectroscopy of aromatic compounds.

Problem assignments: 16-7, 8, 12a,b, 16, 17, 20, 25

Chapter 17: Reactions of Aromatic Compounds.

Electrophilic aromatic substitution including mechanism; Halogenation, nitration and sulfonation of benzene; Nitration of toluene, the effect of alkyl substitution; Orientation effects of various substituents attached to the aromatic ring (ortho-para directors, meta directors); Friedel-Crafts alkylation and acylation reactions including mechanisms; limitations of Friedel-Crafts reactions; reactions of alkylbenzenes; oxidation of alkylbenzenes; halogenation of alkylbenzenes: ring vs side chain; side-chain halogenation of alkylbenzenes; resonance stabilization of the benzyl radical; triphenylmethyl: a stable free radical; stability of the benzyl cation. Nucleophilic substitution of benzyl halides.

Problem assignments: 17-44, 45, 46

Chapter 18. Aldehydes and Ketones. Nucleophilic Addition.

Structure, nomenclature, physical properties and preparation of aldehydes and ketones; analysis of aldehydes and ketones; preparation of aldehydes and ketones by various procedures; reactions: nucleophilic addition; oxidation; reduction; addition of Grignard reagents, cyanide, derivatives of ammonia, alcohols;

Problem Assignments;

18-39, 51, 56, 60, 62

Chapter 19. Amines.

Structure, classification, nomenclature and physical properties of amines; salts of amines; stereochemistry of nitrogen; industrial source and preparation of amines: reduction of nitro compounds, ammonolysis of halides, reductive amination, Hofmann degradation of amides, synthesis of secondary and tertiary amines; heterocyclic amines; Hoffmann rearrangement Basicity and basicity constants of amines; quaternary ammonium salts, exhaustive methylation, Hofmann elimination; conversion of amines into substituted amides; polyamides, Nylon; ring substitution in aromatic amines; sulfonation of aromatic amines, the sulfa drugs; reactions of amines with nitrous acid; diazonium salts,

preparation and reactions; synthesis using diazonium salts; coupling of diazonium salts; analysis of amines.

Problem assignments:

19-36, 41, 42,44

Chapter 20. Carboxylic Acids.

Structure, nomenclature, physical properties, salts of carboxylic acids; industrial source; preparation: Grignard synthesis, nitrile synthesis; reactions; ionization, equilibrium and acidity of carboxylic acids; structure of carboxylate ions; effect of substituents on acidity; conversion into acid chlorides, esters, amides and alcohols; halogenation of acids; dicarboxylic acids; analysis of carboxylic acids.

Problem Assignments:

20-28, 29, 35, 36, 39

Chapter 21. Functional Derivatives of Carboxylic Acids.

Structure, nomenclature and physical properties of carboxylic acid derivatives; nucleophilic acyl substitution; preparation and reactions of: acid chlorides, acid anhydrides, amides, esters, imides; alkaline and acid hydrolysis of esters; ammonolysis and transesterification of esters; reaction of esters with Grignard reagents; reduction of esters; functional derivatives of carbonic acid; step-reaction polymerization, polyesters, polyurethans; analysis of carboxylic acid derivatives.

Problem Assignments:

21-45, 48, 49, 50

Chapter 22. Carbanions

Acidity of α -hydrogens, enolization; reactions involving carbanions; base-promoted and acid-catalyzed halogenation of ketones; aldol and crossed aldol condensations and uses in synthesis; reactions related to aldol condensations; the Wittig reaction; Claisen and crossed Claisen condensations, formation of β -keto esters; Reformatsky reaction. Carbanions in organic synthesis; malonic ester synthesis of carboxylic acids; acetoacetic ester synthesis of ketones; decarboxylation of β -keto acids and malonic acids; direct and

indirect alkylation of esters and ketones; synthesis of acids and esters *via* 2-oxazolines; organoborane synthesis of acids and ketones; enamines.

Problem Assignments

22-61, 63, 64, 65, 67, 69, 70,71

Any remaining time is devoted to various topics including fats, carbohydrates, amino acids heterocyclic compounds, molecular orbitals, depending on the make-up of the class.