Chem 263 – Section A4
Assignment & Lecture Outline 2:
Aromaticity and Reactions of Benzene Derivatives (Electrophilic Aromatic Substitution)

Read

TWG Solomons and CB Fryhle "Organic Chemistry" 8th Edition (2004):

- Functional Group List on pp 70-71 and (Periodic Table) one page back from Inside Back Cover
- Relative Strength of Acids and Bases on Inside Front Cover - same table page 105
- Chapter 14 – Aromatic Compounds – read for overview; study sections 14.1 to 14.10
- Chapter 15 – Reactions of Aromatic Compounds
- Chapter 20 – Sections 20.1; 20.6; 20.7; 20.8; 20.11
- Chapter 21 – Phenols and Aryl Halides

Problems

Do **Not** turn in, answers available in "Study Guide and Solutions Manual for Organic Chemistry" for Solomons. This is available in the Bookstore or can be borrowed from Cameron Library's Reserve Reading Room

- **Chapter 14:** 14.2;14.10; 14.12; 14.16
- **Chapter 15:** 15.1; 15.3; 15.4; 15.7; 15.9; 15.10; 15.13; 15.19; 15.20; 15.26
- **Chapter 20:** 20.11; 20.12; 20.15; 20.16
- **Chapter 21:** 21.1; 21.2; 21.3; 21.13

Lecture Outline #2

I. Review of Aromaticity, Benzene, and Nomenclature

A. Structure and Properties of Benzene

1. Resonance Stabilization

2. Substitution vs. Addition Reactions

B. Annulenes and Huckel's Rule

1. Coplanar Systems of (4n+2) pi Electrons

2. Aromatic Ions - Acidity of Parent Compounds

C. Other Aromatic Systems - Naphthalene, Anthracene, and Heteroaromatic Systems

1. Five membered rings - Furan, Pyrrole, Thiophene, Imidazole

2. Six membered rings - Pyridine, Pyrimidine

D. Nomenclature of Monosubstituted Benzenes

1. As Derivatives of Benzene
2. Common names (Phenol, Aniline, Anisole, etc.)

E. Nomenclature of Multiply-Substituted Benzenes

1. Using Numbers and Common Names
2. Ortho, Meta, Para Nomenclature

II. Electrophilic Substitution Reactions

A. Benzene - General Mechanism

1. Halogenation - X_2
2. Nitration - HNO_3
3. Sulfonation - SO_3 .H_2SO_4
4. Friedel-Crafts Alkylations - Lewis Acid + RX
5. Friedel-Crafts Acylations - Acylium Ions from Acid Halides / Anhydrides
6. Use of Clemmensen Reduction (Zn/Hg and HCl) with Friedel-Crafts Acylation

B. Effects of Substituents

1. Activation vs. Deactivation - Electron Donating vs Electron Withdrawing Groups
2. Orientation - (Ortho-Para vs. Meta)
3. Inductive vs. Resonance Effects
4. Disubstituted Benzene Reactions

III. Reactions of Side Chains and Substituents of Aromatic Systems

A. Nitro to Amino to Diazonium Salts

1. Reduction of Nitrobenzenes to Anilines and Diazotization ($NaNO_3$ and HCl)
2. Replacement of Diazo Group
3. Azo Coupling and Dyes

B. Oxidation of Alkyl Side Chains of Aromatic Compounds to Carboxylic Acids