

**CHEMISTRY 263 - Section A2**  
**Lecture Outline 2 and Assignment 2**

**TR 12:30-13:50**  
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**September 2016**  
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**Assignment 2:**

**Read:** TWG Solomons and CB Fryhle "Organic Chemistry" 11<sup>th</sup> Edition (2014):

**Functional Group List** on pp 76 and **Periodic Table** Inside front Cover (One page back from Inside Back Cover earlier Editions)

Relative **Strength of Acids** and Bases on Inside Front Cover - same table page 111 (page 101 9<sup>th</sup> Edition & page 105 - 8<sup>th</sup> Edition)

**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 in 8<sup>th</sup> Ed or 20.9 in 9<sup>th</sup> Ed)

**Chapter 21** – Phenols and Aryl Halides – focus on structure, nomenclature, electrophilic reactions

**Problems:** (Do Not turn in, answers available in "Study Guide and Solutions Manual for Organic Chemistry" for Solomons.

**Chapter 14:** practice problems 14.1; 14.3; 14.10; 14.12; 14.16; 14.17; 14.18; 14.21

**Chapter 15:** practice problems 15.1; 15.2; 15.5; 15.7; 15.8; 15.11; 15.17; 15.22a; 15.24; 15.25

**Chapter 20:** practice problems 20.10; 20.11; 20.13; 20.14;

**Chapter 21:** review problems 21.1; 21.2; 21.13; 21.14

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**Lecture Outline 2: Aromaticity and Reactions of Benzene Derivatives (Electrophilic Aromatic Substitution)**

**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 -  $SO_3 \cdot H_2SO_4$
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