CHEMISTRY 263 - Section A2

Lecture Outline 3 and Assignment 3

TR 12:30-13:50 **October 2016**
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Assignment 3:

Read: TWG Solomons and CB Fryhle "Organic Chemistry" 11th 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 9th Edition & page 105 - 8th Edition)

Chapter 11 – Alcohols and Ethers - nomenclature and properties, prep & reactions

Chapter 12 – Alcohols from Carbonyl Compounds

Chapter 16 – Aldehydes and Ketones - Carbonyl Reactions

Chapter 18 – Aldehydes and Ketones – Reactions at α-Carbon, Aldol

Chapter 22 – Carbohydrates – read for overview structure and properties

Problems: do review problems below - answers in "Solutions Manual " for Solomons.

Chapter 11: 11.2; 11.3; 11.5 to 11.7; 11.11 to 11.13; 11.15 to 11.17; 11.20; 11.23; 11.25; 11.26; 11.28; 11.32

Chapter 12: 12.1; 12.3 to 12.8; 12.10; 12.11

Chapter 16: 16.1; 16.4; 16.7; 16.9 to 16.11; 16.17; 16.19; 16.28

Chapter 18: 18.1; 18.2; 18.6a; 18.16; 18.19

Chapter 22: 22.1; 22.2; 22.3; 22.5; 22.20; 22.28

Lecture Outline 3: Alcohols and Ethers, Stereochemistry Review, Aldehydes and Ketones - Properties of the Carbonyl Group

I. Structure, Nomenclature and Physical Properties of Alcohols and Ethers
- A. Aliphatic Alcohols
- B. Aromatic Alcohols (Phenols)
- C. Ethers
- D. Alcohols and Phenols - general properties
  1. MP, BP, solubility, density - hydrogen bonding
  2. Acidity of Aliphatic Alcohols (ROH)
- E. Acidity of Phenols (ArOH) - resonance
- F. Physical Properties of Ethers

II. Review of Stereochemistry - "Fixed three dimensional arrangements" **Review Chapter 5**
- A. The Concept of Chirality
  1. Identification of chiral objects and molecules - definitions
  2. Types of stereoisomers - enantiomers and diastereomers
  4. Racemic mixtures - 50-50 mixtures of enantiomers
- B. The R and S Nomenclature System
  1. Rules for assignment of R and S configurations

C. Molecules with more than one chiral center
    1. Enantiomers and Diastereomers
    2. Meso compounds - chiral centers with plane of symmetry within molecule
    3. Recognition of chiral centers in complex molecules

III. Structure, Nomenclature, Properties of Aldehydes and Ketones
A. Nature of the Carbonyl Group - Physical Properties
    1. Polarity and Reactivity
    2. Hybridization and shape (sp^2, planar)
    3. Physical Properties - BP, MP, solubility, smell
B. Nomenclature of Aldehydes - RCHO
    1. IUPAC - alkane name, replace "e" with "al"
C. Nomenclature of Ketones - RCOR
    1. IUPAC - alkane name - replace "e" with "one"

IV. Preparation of Aldehydes and Ketones
A. Aldehydes
    1. Oxidation of Primary Alcohol: RCH_2OH -> RCHO
    2. Reduction of Acyl Halides: RCOX -> RCHO
B. Ketones
    1. Friedel-Crafts Acylations
    2. Oxidation of 2° Alcohols R_2CHOH to R_2CO
    3. With Organometals: RMgX, R_2Cd, R_2CuLi

V. Reactions of Aldehydes and Ketones
A. Nucleophilic Additions at the Carbonyl Carbon Atom
    1. General considerations - strong vs. weak nucleophiles
    2. Cyanohydrin formation
    3. Grignard reagent addition
    4. Reduction (hydride addition)
    5. Hemiacetal and Acetal formation
B. Nucleophilic Addition - Elimination at the Carbonyl Carbon
    1. Wittig Reaction
    2. Addition of Derivatives of Ammonia: formation of oximes, hydrazones, imines
    3. Cannizzaro Reaction of Aldehydes with no alpha hydrogen
C. Reactions at the α-carbon
    1. Enolate formations - Keto - enol tautomerism
    2. Halogenation and Haloform Reaction
    3. Alkylation
    4. Aldol Addition
D. Reactions of α,β-unsaturated aldehydes and ketones
    1. Conjugate Addition vs Simple Addition

VI. Carbohydrates
A. Monosaccharides
    1. Classification - aldose, ketose, triose, tetrose, etc.
    2. Stereoisomerism
    3. Anomers and Ring Formation (Hemiacetals, Acetals)
    4. Properties and Sweet Taste
B. Disaccharides and Polysaccharides
    1. Sucrose
    2. Cellulose, Starch, Glycogen