**110b Exam 2 Review Sheet- Spring Semester 2020**

**Review Session: Wednesday, February 26, 7:00 PM, SN Aud**

**Examination: Friday, February 28, 7:50 & 8:50 AM, SN Aud**

**Chapter 16:**

1. Hammett plots as a commonly used Linear Free Energy Relationship (LFER), a general method for examining changes in charges during a chemical process. [handout]

2. Nomenclature- be familiar with examples in the text. [10e, 729-731; 11e, 720-722]

3. Synthesis of aldehydes: PCC oxidation of 1° alcohols, know the reagent composition and reaction (~~review the mechanism~~). Ozonolysis of alkenes (review from first semester). DIBAL reduction of esters; know the structure of the reagent and ~~mechanism of reaction~~. Extend your ~~mechanistic insights~~ to the DIBAL reduction of nitriles. Li(Ot-Bu)3AlH reduction of acid chlorides to aldehydes: ~~mechanism~~ and utility in synthesis. [10e, 733-738; 11e, 724-729]

4. Synthesis of ketones: Review those from last semester and chapter 15. Ketones from the reaction of nitriles with RMgX or RLi, know the mechanism of this reaction and identify the unstable imine intermediate. [10e, 738-739; 11e, 729-731]

5. Nucleophilic addition reactions involving C=O bonds, and the relative reactivity of aldehydes vs. ketones. [10e, 741-744; 11e, 732-734] Hydration of aldehydes and ketones.

6. Acetals and ~~ketals~~ and their hemi- forms. Be able to identify these functional groups. Know the mechanism of formation/hydrolysis for an acetal (e.g., acetaldehyde + 2CH3OH + H+(cat.)). Be aware of the utility of acetals and ~~ketals~~ [and their thio (sulfur) analogs] as protecting groups in organic synthesis. [10e, 744-750; 11e, 735-741]

7. The addition of amines to aldehydes and ketones: mechanisms for imine and ~~enamine~~ formation. You should be familiar with the related chemistry of oximes and hydrazones. [10e, 751-755; 11e, 741-746]

8. The addition of HCN to aldehydes and ketones. Mechanism of cyanohydrin formation and synthetic utility of products. [10e, 755-756; 11e, 746-747]

9. The Wittig reaction. Mechanism of reaction, definition of ylide, oxaphosphetane. ~~The Horner-Wadsworth-Emmons Modification.~~ Utility in synthesis. [10e, 757-761; 11e, 747-751]

10. Spectroscopic and chemical evidence for aldehydes and ketones. 1H, 13C NMR and IR. [10e, 761-764; 11e, 753-756]

1. Be able to employ the reactions of chapter 16 in synthetic proposals, predict the products, and mechanistic analyses.

**Chapter 17:**

1. Nomenclature: Review the names presented in lecture for C.1-C.3 ~~C.6, C.12~~, ~~C.16, and C.18~~ acids and related derivatives presented in lecture. Be familiar with the nomenclature of acid derivatives as covered in the text. [10e, 779-786; 11e, 771-778]

2. Review the properties and spectroscopic properties of acyl compounds as presented in class. [10e, 787-789; 11e, 779-781]

3. Acidity. Have in mind a chemically relevant definition of pKa. Make a table of the pKa’s we’ve discussed throughout the course. Review the general factors which affect acidity. [10e, 781-783; 11e, 773-775]

4. Preparation of carboxylic acids. Review the synthetic methods (6 review reactions) and know the scope and mechanisms of reaction for the two new methods we discussed: ~~(i) carbonation of a Grignard reagent~~ and (ii) acid/base hydrolyses of nitriles. [10e, 789-791; 11e, 781-784]

5. Review the general mechanism of nucleophilic addition/elimination reactions involving carbonyl groups of various types. Review the factors we have used to rate the relative reactivity of acyl compounds. [10e, 792-794; 11e, 784-786]

6. Preparation and reactions of acid chlorides. ~~Know the mechanism of the thionyl chloride method~~. [10e, 794-796; 11e, 786-788]

7. ~~Preparation~~ and reactions of acid anhydrides. [10e, 796-797; 11e,788-789]

8. Esters and lactones: mechanism of the Fischer esterification; ~~ester syntheses using S~~~~N~~~~2 chemistry~~; ester syntheses using activated carbonyl groups. Mechanism of basic saponification of esters, ~~use of isotopes to support mechanisms of acyl vs. alkyl attack~~. Lactones-- know the relevant nomenclature, properties, and reactions. [10e, 797-804; 11e, 789-795]

9. Amides and lactams: methods for the synthesis of amides: know the DCC process but don’t worry about the mechanism. Hydrolysis of amides: know the acid and base mechanisms, compare these hydrolyses with the ester case in terms of ease of hydrolysis. Lactams--nomenclature, properties, occurrence, and reactions. [10e, 804-812; 11e, 796-802]

10. ~~The chemistry of carbonates and carbamates. Be familiar with one useful application of a carbamate. [10e, 812-814; 11e, 802-806]. Know how carbamates can lose CO~~~~2~~ ~~when deprotected.~~

1. Be able to use the reactions of Chapter 17 in synthetic and mechanistic proposals/evaluations and in predict the product type of questions.