

Chapter 20 Lecture Outline

"Carboxylic Acids and Nitriles"

(problems: 20abc, 21 abc, 23, **25-28**, 29, **33-34**, 35, **36, 39**, 40-42, 49, 52-55)

I. Nomenclature

II. Acidity of Carboxylic Acids

- A. Why are Carboxylic Acids Acidic?
- B. Substituent Effects on Acidity of Carboxylic Acids (and Benzoic Acids)

III. Preparation of Carboxylic Acids

- A. Oxidative Cleavage (by KMnO_4) of Alkenes (with vinyl hydrogens)
- B. Oxidative Cleavage (by KMnO_4) of Alkyl Benzenes (with benzylic hydrogens)
- C. Jones Oxidation (aq H_2CrO_4) of Aldehydes or 1° Alcohols
- D. Hydrolysis of Nitriles (acid or base catalyzed)
- E. Carboxylation (rxn with CO_2) of Grignard Reagents

IV. Reactions of Carboxylic Acids

- A. Deprotonation
- B. Reduction by LiAlH_4 or BH_3

V. Nitriles - Nomenclature

VI. Preparation of Nitriles

- A. Nucleophilic Substitution ($\text{S}_{\text{N}}2$) of Alkyl Halides (1° or 2°) by CN^-
- B. $-\text{NH}_2$ Amide Dehydration with Thionylchloride (SOCl_2)

VII. Reactions of Nitriles

- A. Hydrolysis to give Carboxylic Acids (see III.D.)
- B. Reduction with LiAlH_4 to give 1° Amines
- C. Addition by Grignard Reagents to give, after hydrolysis, Ketones

VIII. Spectroscopy of Carboxylic Acids and Nitriles

- A. IR Spectroscopy
- B. $^1\text{H-NMR}$ and $^{13}\text{C-NMR}$ Spectroscopy