

Major Topics for First Exam - Chapters 9,12,13

Chapter 9 - Spectroscopic Methods

1. Describe basic principles of IR, NMR, and Mass spectra
2. Identify functional group (s) indicated by IR spectrum
3. NMR spectrum - proton
 - a. Identify how many signals expected from a molecule
 - b. Understand principles of chemical shift, peak intensity, and coupling
 - c. Given a structure, be able to predict its nmr
 - d. Given an nmr spectrum, identify the structure
4. Carbon-13 NMR
 - a. How many signals from a particular molecule
 - b. Using DEPT information about number of H on each C, identify a structure
5. Identify a molecular formula from its mass spectrum
 - a. M, M+1, M+2 peaks
 - b. Understand basic fragmentation principle = more stable cations and radicals
7. Identify an unknown compound based on its total spectral properties

Chapter 12 - Oxidation, Reduction, and Organometallics

1. Identify organic reactions that are oxidations and reductions
2. Reduction of carbonyl compounds with hydride reducing agents
 - a. Understand differences between LiAl hydride and NaBorohydride
3. Recognize when chirality is created by a reduction
4. Apply oxidation reactions to alcohols to make aldehydes, ketones, and carboxylic acids
 - a. Note selectivity of PCC, whereas other oxidizing agents are stronger
 - b. Tertiary alcohols are not readily oxidized
5. Formation of organolithium and magnesium compounds
 - a. Reaction of organometallics with any acidic hydrogen
6. The Grignard Reaction - addition of RMgBr with aldehydes, ketones, and esters
 - a. Predict products of a Grignard reaction
 - b. Be able to do retrosynthesis to identify starting materials for complex alcohols
7. Other organometallics - organolithium and alkynides also add to carbonyls
8. Grignards with epoxides - produces more substituted alcohol with and trans stereochem.

Chapter 13 - Conjugation

1. Stability of allyl radicals, including Molecular Orbital and Resonance basis for stability
2. Allylic bromination with NBS
3. Conjugated dienes = 1,3-dienes - stability and conformations
4. Principles of UV spectroscopy and application to strongly conjugated molecules
5. 1,4 addition - kinetic vs thermodynamic control
 - a. Role of allyl cation
6. Diels-Alder Reaction - be able to write products
 - a. Alignment of molecular orbitals, requires concerted syn addition from s-cis diene

- b. Preference for endo products
- c. Use retrosynthesis principles to make six membered rings