CONTENTS

CHAPTER 1 *AROMATICITY* **1**

1.1 Introduction to Aromatic Compounds **1**
1.2 Nomenclature of Aromatic Compounds **2**
1.3 Criteria for Aromaticity **6**
1.4 Lone Pairs **9**

CHAPTER 2 *IR SPECTROSCOPY* **11**

2.1 Vibrational Excitation **11**
2.2 IR Spectra **13**
2.3 Wavenumber **13**
2.4 Signal Intensity **18**
2.5 Signal Shape **19**
2.6 Analyzing an IR Spectrum **26**

CHAPTER 3 *NMR SPECTROSCOPY* **33**

3.1 Chemical Equivalence **33**
3.2 Chemical Shift (Benchmark Values) **36**
3.3 Integration **41**
3.4 Multiplicity **44**
3.5 Pattern Recognition **46**
3.6 Complex Splitting **48**
3.7 No Splitting **49**
3.8 Hydrogen Deficiency Index (Degrees of Unsaturation) **50**
3.9 Analyzing a Proton NMR Spectrum **53**
3.10 ^{13}C NMR Spectroscopy **57**

CHAPTER 4 *ELECTROPHILIC AROMATIC SUBSTITUTION* **60**

4.1 Halogenation and the Role of Lewis Acids **61**
4.2 Nitration **65**
4.3 Friedel–Crafts Alkylation and Acylation **67**
4.4 Sulfonation **74**
4.5 Activation and Deactivation **78**
4.6 Directing Effects **80**
4.7 Identifying Activators and Deactivators **89**
4.8 Predicting and Exploiting Steric Effects **99**
4.9 Synthesis Strategies **106**

CHAPTER 5 *NUCLEOPHILIC AROMATIC SUBSTITUTION* **112**

5.1 Criteria for Nucleophilic Aromatic Substitution **112**
5.2 S_NAr Mechanism **114**
5.3 Elimination–Addition **120**
5.4 Mechanism Strategies **125**

CHAPTER 6 *KETONES AND ALDEHYDES* **127**

6.1 Preparation of Ketones and Aldehydes **127**
6.2 Stability and Reactivity of C═O Bonds **130**
6.3 H-Nucleophiles **132**
6.4 O-Nucleophiles **137**
6.5 S-Nucleophiles **147**
6.6 N-Nucleophiles **149**
6.7 C-Nucleophiles **157**
6.8 Exceptions to the Rule **166**
6.9 How to Approach Synthesis Problems **170**

CHAPTER 7 *CARBOXYLIC ACID DERIVATIVES* **176**

7.1 Reactivity of Carboxylic Acid Derivatives **176**
7.2 General Rules **177**
7.3 Acid Halides **181**
7.4 Acid Anhydrides **189**
7.5 Esters **191**
7.6 Amides and Nitriles **200**
7.7 Synthesis Problems **209**

CHAPTER 8 *ENOLS AND ENOLATES* **217**

8.1 Alpha Protons **217**
8.2 Keto-Enol Tautomerism **219**
8.3 Reactions Involving Enols **223**
8.4 Making Enolates **226**
8.5 Haloform Reaction **229**
8.6 Alkylation of Enolates **232**
8.7 Aldol Reactions **236**
8.8 Claisen Condensation **242**
8.9 Decarboxylation **249**
8.10 Michael Reactions **256**

CHAPTER 9 *AMINES* **263**

9.1 Nucleophilicity and Basicity of Amines **263**
9.2 Preparation of Amines Through S_N2 Reactions **265**
9.3 Preparation of Amines Through Reductive Amination **268**
9.4 Acylation of Amines **273**
9.5 Reactions of Amines with Nitrous Acid **276**
9.6 Aromatic Diazonium Salts **279**

CHAPTER 10 *DIELS–ALDER REACTIONS* **282**

10.1 Introduction and Mechanism **282**
10.2 The Dienophile **285**
10.3 The Diene **286**
10.4 Other Pericyclic Reactions **292**

Detailed Solutions **S-1**
Index **I-1**