

Lecture topics and schedule

1st Segment. *Fundamental Organic Reactions (7 lectures)*

Chap 16 Aromaticity in the ground state: aromatic, antiaromatic, and nonaromatic compounds

Chap 22(5-6) Pseudo-aromaticity in the transition state: cycloaddition and Diels-Alder reaction
(2.5 Lectures)

1. MO energy diagram: $4n+2$ closed-shell vs. $4n$ open-shell electron configuration
2. Applications of aromaticity
3. Diels-Alder reaction ($4n+2$ e in TS) and photo-cycloaddition ($4n$ e in TS)

Chap 17 Electrophilic and nucleophilic substitutions of aromatics (Ionic Rx)
(3 Lectures)

1. $S_{E}Ar$ of benzene
2. $S_{E}Ar$ substituent effects: orientation and reactivity
3. $S_{N}Ar$ of aryl halides by addition-elimination
4. $S_{N}Ar$ via a benzyne intermediate: elimination-addition
5. Arylamine diazotization to form diazonium ion: substitution and coupling

Chap 21 Radical chemistry

Chap 24(1) Radical chain polymerization

(1.5 Lectures)

1. Radical generation
2. Radical substitution reactions: halogenation, autooxidation
3. Radical addition to pi-bonds and polymerization

2nd Segment. *Synthetic Chemistry (7 lectures)*

Chap 18 Nucleophilic additions of aldehydes and ketones

(2 Lectures)

1. Reversible additions by O and N nucleophiles
2. Additions by strong nucleophiles like C^- (Grignard, Wittig reactions) and H^- (reduction)

Chap 19 Nucleophilic acyl substitutions of carboxyl derivatives

(2 Lectures)

1. Carbonyl character of carboxyl derivatives
2. Interconversions of carboxyl derivatives by nucleophilic acyl substitution
3. Organometallic and hydride reactions

Chap 20 Enolate and other carbon nucleophiles

Chap 23(1-4) Protecting groups

(3 Lectures)

1. Keto-enol tautomerism: α -carbanion
2. Aldol condensation
3. Claisen condensation
4. β -Ketoester and malonate alkylation
5. Other alkylations at the α -carbon (via Li enolate, enamine)
6. Other reactions at the α -carbon (racemization, halogenation)
7. Conjugate vs. direct additions
8. Protecting groups

3rd Segment. *Biomolecule Structure-function (7 lectures)*

Chap 28 Other natural products (Lipids)

(1.5 Lectures)

1. Lipid structures: nC_5 and nC_2
2. Biosynthesis and synthesis of lipids
3. Structure-function of triglycerides and derivatives

Chap 25 Carbohydrates

(2 Lectures)

1. Structures of carbohydrates from glucose to glycan (polysaccharide)
2. Carbohydrate structure-function
3. Chemistry for carbohydrate activities

Chap 26 Amino acids, peptides, and proteins

(2 Lectures)

1. Amino acid structures, properties, and synthesis
2. Chemistry for polypeptide sequencing and synthesis of polypeptides
3. Polypeptide structure-function (4 levels of structure: 1°, 2°, 3°, 4°)
4. Catalysis – Enzyme chemistry

Chap 27 Nucleotides and nucleic acids

(1.5 Lectures)

1. Structure-function of base-pairing template
2. Activated phosphate derivatives in biological vs. synthetic chemistry
3. Rationale for the ribose-phosphate backbone in nucleic acids

1st Segment. *Fundamental Organic Reactions*

Chap **16** Aromatic, antiaromatic, and nonaromatic compounds

Problems: **16.** 3, 6, 8, 12, 13, 15, 18. Figure: **16.2**

Chap **22(5-6)** Cycloaddition and Diels-Alder reaction

Problems: **22.** 10, 13, 14ajk. Figure: **22.2**

Chap **17** Aromatic substitutions

Problems: **17.** 1, 3, 6, 7bc, 9c, 15, 19bc, 23adg, 24, 25, 26c, 29ahi. Figures: **17.1, 2, 3, 5**

Chap **21** Radical chemistry

Problems: **21.** 5abce, 8df, 15a. Figures: **21.1, 2**

Chap **24(1)** Radical chain polymerization

Problems: **24.** 1, 3

2nd Segment. *Synthetic Chemistry*

Chap **18** Nucleophilic additions to aldehydes and ketones

Problems: **18.** 2cd, 3, 9adef, 10ab, 13, 14, 19, 20bc, 23, 24, 25abd, 26be Figures: **18.1, 2, 3, 5**

Chap **19** Nucleophilic acyl substitutions of carboxyl derivatives

Problems: **19.** 2, 8, 9, 12ef, 13, 14ab, 16c, 17abd, 21. Also p.839. Figures: **19.2, 3, 5, 6, 7**

Chap **20** Enolate and other carbon nucleophiles

Problems: **20.** 1, 6bd, 7abd, 9, 11abc, 14, 19, 22b, 27, 29ab. Figures: **20.1, 2, 3, 4**

Chap **23(1-4)** Protecting groups

Problems: **23.** 3. Figure: **23.1**

3rd Segment. *Biomolecule Structure-function*

Chap **28** Other natural products (Lipids)

Problems: **28.** 2, 3, 8, 34, 35. Figures: **28.** 2, 3, 10. Section: **28.8**
21.11, 12

Chap **25** Carbohydrates

Problems: **25.** 5, 6, 18, 24, 26, 27, 30, 44, 45, 46, 47. Also p.880-1 (Aldol in metab).

Figures: **25.2, 3**

Chap **26** Amino acids, peptides, and proteins

Problems: **26.** 6, 10, 11, 17ac, 19, 20, 21, 22, 23, 37. Also P.1139, Section 26.8

Figures: **26.3, 4, 8**

Chap **27** Nucleotides and nucleic acids

Problems: **27.** 5, 6, 7, 8, 11, 12, 16, 18, 22, 23, 24, 25.

Figures: **27. 9**

NOTE: For better efficiency in learning, try doing the problems twice, 1st time **with** the Study Guide to make connection with the answers given, 2nd time do **on your own** and reason it out (and do a lot of what ifs). If you don't see it the 1st time, look up the specific section dealing with that subject matter, i.e., use the book as a dictionary (if you spend the time reading the whole chapter, do you have time left to tackle the problems?)