

Chemistry 218
Study Guide, Final

Ch. 14: NMR:

¹³C NMR (Table will be provided)

Spin-spin coupling

coupling

complex splitting patterns (ex. dd, dt, ddd, etc)

Ch. 13: Mass Spectroscopy

Interpretation of a spectrum

assignment of simple fragments

Ch. 10/11: Alkenes and Alkynes

Acid catalyzed additions

HX

H₃O⁺

Hydroboration / Oxidation

Addition of X₂

Addition of X₂ in presence of another nucleophile

Ch. 12

Hydrogenation

H₂, Pd/C

H₂, Lindlar

Li/NH₃

Epoxidation of alkenes

Dihydroxylations

OsO₄

KMnO₄

Oxidative cleavage

KMnO₄

O₃

Ch. 15: Radical Reactions

Radical additions to alkenes

Ch. 16: Conjugated systems

allylic systems (radicals, cations, anions): resonance, molecular orbital description

reactivity of allylic position (ease of formation of radical, cation, anion)

conjugated systems: M.O. description

1,4-additions

kinetic vs. thermodynamic control

Diels-Alder (starting materials, products, stereochemistry)

Ch. 17: Benzene and Aromatic Compounds

Nomenclature of benzene

Molecular orbital description of aromaticity: inscribed polygon

Hückel's Rule

Aromatic, Non-aromatic, anti-aromatic compounds

Ch. 18: Reactions of Aromatic Compounds

General mechanism for EAS

Halogenation of aromatics

Nitration of aromatics

Sulfonation of aromatics

Friedel-Crafts Alkylation

Friedel-Crafts Acylation

Activating vs. deactivating groups

ortho/para vs. meta directors

Synthesis of multi-substituted benzene rings

Ch. 12.2: Oxidation of Alcohols

“oxidation states” of carbon

oxidation

PCC in CH_2Cl_2

CrO_3 , H_2CrO_4 , or KCr_2O_7 in $\text{H}_2\text{O}/\text{H}^+$

Ch. 20: Reduction and Organometallic addition to carbonyls

reduction

NaBH_4 , LiAlH_4 , DIBAL-H, DIBAL-H, $-78\text{ }^\circ\text{C}$

organolithiums and Grignards

formation from alkyl halides

reactions with aldehydes, ketones, esters, acid chlorides, epoxides

cuprates

formation

reactions with acid chlorides

Conjugate (1,4)-additions

Protecting groups

Ch. 21: Aldehydes and Ketones: Nucleophilic Addition

Nomenclature

Synthesis of hemiacetals, gem-diols (hydrates), acetals

Synthesis of imines and enamines

Hydrolysis of hemiacetals, gem-diols, acetals, imines and enamines

Synthesis of cyanohydrins

Nucleophilic addition to nitriles

Wittig, Horner Emmons

Ch. 22: Carboxylic Acids and Derivatives

Nomenclature

Nucleophilic Acyl Substitution

Conversion of acid chlorides \rightarrow anhydrides, acids, esters, amides

Conversion of anhydrides \rightarrow acids, esters, amides

Conversion of esters \rightarrow acids

Conversion of carboxylic acids into:

Acid chlorides (SOCl_2)

Anhydrides (heat)

Esters (H^+ , ROH)

Amides (DCC)

Nitriles

Hydrolysis

Nucleophilic addition (H^- , R-Li, R-MgX)

Ch. 23

Keto-enol tautomerization

Formation of enolates

Thermodynamic and kinetic enolates

Halogenation

Alkylation of enolates

Malonic ester and acetoacetic acid synthesis (decarboxylation)

Ch. 24

Aldol

Using weak base

Aldol / dehydration

Crossed aldol

Using strong base

Claisen

Crossed Claisen

Michael reaction

Robinson Annulation

Ch. 26

Metathesis

Ch. 27

General structure of carbohydrates

Formation of hemi-acetals

Formation of acetals

Ch. 28: Amino Acids and Proteins:

Generic structure of amino acids

Generic structure of peptides

Solid phase peptide synthesis

Ch. 30

General idea behind chain-growth and step-growth polymers