

Chem 152 Notes

Chapter 14 – Alcohols

I. Nomenclature and Properties

A. IUPAC

1. find longest chain with C-OH, use appropriate root word
2. drop -e and add -ol in suffix
3. number so that the alcohol gets the lowest possible number
4. multiple alcohols are -diol, -triol, etc.

ex:

ex:

ex:

ex:

ex:

ex:

B. Common names

isopropyl alcohol

phenol

C. Properties

H-bonding

high b.p.

water soluble

polar

D. Natural products

II. Formation

A. Industrial

1. oxo process

2. fermentation

B. Laboratory methods

1. from alkene

ex:

2. from carbonyl

ex:

III. Reactions

A. Dehydration

in general:

mechanism:

ex:

ex:

B. Oxidation using $K_2Cr_2O_7$ or $KMnO_4$ or dimethylsulfoxide (DMSO)/ Ac_2O , or cytochrome P450

a. 1° ROH

in general:

mechanism:

ex:

ex:

ex:

ex:

b. 2° ROH
in general:

mechanism:

ex:

ex;

ex:

ex:

c. 3° ROH
in general:

ex;

ex:

ex:

ex:

4. phenol

C. Substitution using PX_3

in general:

mechanism:

ex:

ex:

ex:

ex:

D. Alkoxide chemistry

acid-base equilibrium

alkoxide as nucleophile

ex:

ex:

ex:

ex:

ex:

ex:

Order of acidity:

IV. Analysis

A. Chemical

Lucas test

B. Spectroscopic

Infra-red spectroscopy (IR)

Nuclear magnetic resonance spectroscopy (NMR)

Ethers

I. Nomenclature and Properties

A. IUPAC

ex:

ex:

ex:

ex:

B. Common system alkyl alkyl ether

ex

ex:

ex:

ex:

C. Properties

low b.p.

non-reactive

small ethers are anesthetic

II. Formation

Williamson ether synthesis

III. Reactions

IV. Analysis

like alkanes

Thiols

I. Nomenclature and Properties

A. IUPAC

B. Properties

II. Formation

III. Reactions

A. Oxidation

B. Reduction

IV. Analysis

Chapter 15 – Ketones and Aldehydes

I. Nomenclature and Properties

A. IUPAC

1. aldehydes

-find longest chain with –CHO, use appropriate root word

-drop the –e and add –al

-aldehyde carbon is #1

-if higher priority is present then use oxo- as prefix

ex:

ex:

ex:

ex:

2. ketones

-find longest chain with carbon doubly bonded to oxygen, use root word

-drop –e and add –one

-number the chain so that the ketone carbon gets the lowest possible #

-if higher priority is present then use oxo- as prefix

-if two ketones then –dione is suffix, etc.

ex:

ex:

ex:

ex:

ex:

ex:

B. Common names

acetone

acetaldehyde

formaldehyde

benzaldehyde

C. Properties

D. Natural products

II. Formation

A. Aldehydes

1. oxidation of primary alcohols

ex:

ex:

2. reduction of acid derivatives

B. Ketones

1. oxidation of secondary alcohols

ex:

ex:

2. reduction of acid derivatives

III. Reactions

A. Oxidation

in general:

ex:

ex:

ex:

ex:

B. Hydrogenation

in general:

mechanism:

ex:

ex:

ex:

alkenes > aldehyde > ketone > aromatic ring

ex:

ex:

C. With nucleophiles

1. hydride

 NaBH_4 LiAlH_4 (LAH)

NADH

in general:

mechanism:

ex:

ex:

ex:

ex:

in general: 2. water

mechanism:

ex:

ex:

in general: 3. alcohol

mechanism:

acetal

ex:

ex:

ex: make 2,2-dimethoxy-4-methylpentane from any ketone

ex: reversible reaction

ex:

in general: 4. amine

ex:

ex:

retinal and opsin in vision

in general: 5. carbon anion (carbanion)

mechanism:

ex:

ex:

ex:

ex:

D. Enolate chemistry

1. formation

ex:

ex:

ex:

ex:

2. reaction with electrophiles

a. acid (H^+)

ex:

ex:

b. X_2

in general:

mechanism:

ex:

ex:

c. RX

in general:

ex:

ex:

in general: d. ketone or aldehyde

mechanism:

ex:

ex:

ex: make 4-hydroxy-4-phenyl-2-butanone

ex: make 2-butenal from ethanol

ex: prostaglandin formation

IV. Analysis

A. Chemical

Tollen's test

bromine decolorization

B. Instrumental