REACTIONS OF ORGANIC COMPOUNDS

PART TWO:

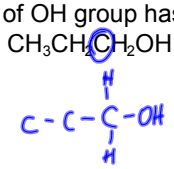
ORGANIC FAMILIES

Types of Alcohols

Primary (1^0)

- OH group on end
- Carbon of OH group attached to only one other carbon
- Carbon of OH group has two other H's attached to it

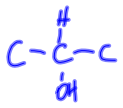
eg. $CH_3CH_2CH_2OH$ 1-propanol



Secondary Alcohol (2^0)

- OH group not on end
- Carbon of OH group attached to two other carbons
- Carbon of OH group has only 1 other H attached to it

eg. CH_3CHCH_3 (OH) 2-propanol



- Tertiary Alcohol (3^0)

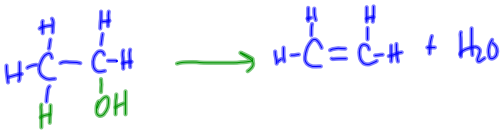
- Carbon of OH group attached to three other carbons
- Carbon of OH group has no other H's attached to it.

Eg. CH_3CCH_3 (CH_3, OH) 2-methyl-2propanol

Dehydration (Elimination)

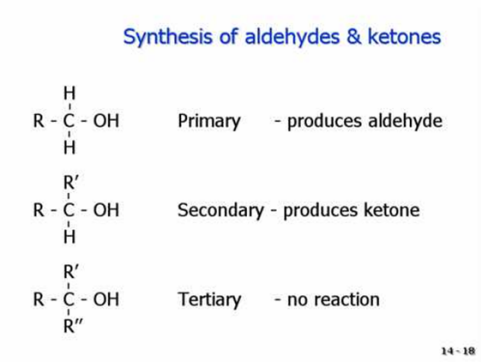
- Using concentrated sulfuric acid, removes water from an alcohol to produce an alkene

ethanol $\xrightarrow[\text{conc } H_2SO_4]{\text{catalyst}}$ ethene + water



Oxidation Reactions: making an aldehyde or a ketone

- Oxidation (in organic chemistry) is defined as a reaction in which a carbon atom forms more bonds to oxygen, or less bonds to hydrogen
- Uses $KMnO_4$ (or $K_2Cr_2O_7$ in H_2SO_4) "[O]"
- 1° alcohol makes an aldehyde
- 2° alcohol makes a ketone

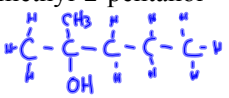


Aldehydes can be oxidized further…..

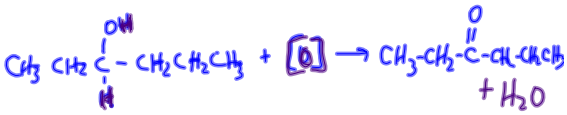
- Primary alcohol → aldehyde → carboxylic acid
- Secondary alcohol → ketone
- Tertiary alcohol → no oxidation

eg.

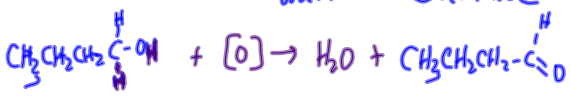
2-methyl-2-pentanol + [O] --> NR



3-hexanol + [O] --> 3-hexanone + water



1-butanol + [O] --> water + butanal

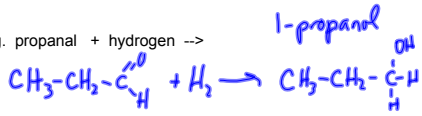


butanal + [O] ⟶ butanoic acid

(opposite of oxidation....)

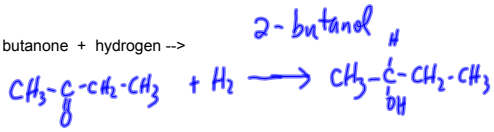
Aldehydes can be hydrogenated to make a primary alcohol

eg. propanal + hydrogen --> 1-propanol



Ketones can be hydrogenated to make a secondary alcohol

eg. butanone + hydrogen --> 2-butanol



Making esters

- Esters are organic salts
- Recall, acid + base → water + salt

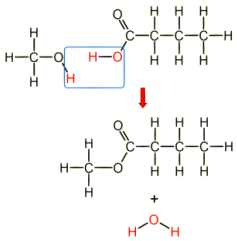
In the organic world

- Organic acid + organic base→ water + ester
  (carbox. Acid) (alcohol)

esterification

Esters

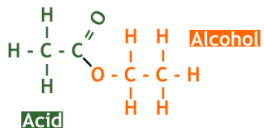
formed when a carboxylic acid reacts with an alcohol in the presence of a catalyst. A condensation reaction occurs yielding an ester and water.



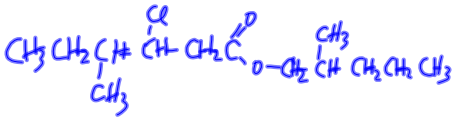
methyl butanoate

How to Name an Ester:

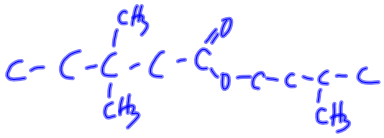
1. Name the alcohol first.
2. Change the "ol" ending to "yl"
3. Change acid name from "anoic acid" to "anoate"



2-methylpentyl-3-chloro-4-methylhexanoate

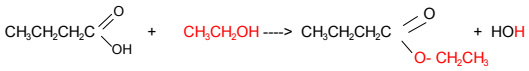


3-methyl butyl-3,3-dimethylpentanoate



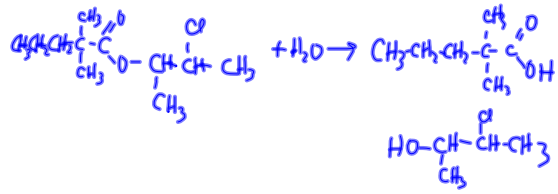
Condensation Reaction (Esterification)

butanoic acid + ethanol --> ethyl butanoate + water



hydrolysis

1-methyl-2-chloropropyl-2,2-dimethylpentanoate + water →



ALCOHOLS

2-ethyl-3-chlorohexanol

2,2-dichloropentanol

2-chloro-2-methylpropanol

ACIDS

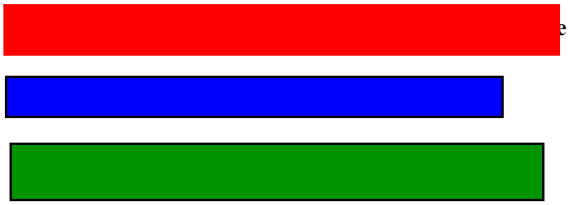
3-chloro-4,4-dimethylpentanoic acid

2-methylbutanoic acid

3-chloro -2-ethylhexanoic acid

Pg 39 #4,5
Pg 45 #1,2,3
Pg 55 #4,8,9
pg 50 #1,2

ESTERS



SUMMARY OF REACTIONS

alkanes and aromatics
- substitution rxns only

alkane + halogen---> alkyl halide (1 halogen substitution) + hydrogen halide

alkenes
-addition rxns

alkene + hydrogen --> alkane

alkene + halogen --> alkyl halide (2 halogens)

alkene + hydrogen halide --> alkyl halide (1 halogen substitution)

alkene + water --> alcohol

alcohols
-dehydration to make an alkene

alcohol ----------> alkene + water

-oxidation

primary alcohol + [O] --> aldehyde
aldehyde + [O] --> carboxylic acid

secondary alcohol + [O] --> ketone

-esterification (condensation)

alcohol + carboxylic acid --> ester + water

hydrolysis of esters ester + water --> carboxylic acid + alcohol

WORKING BACKWARDS.....

make the ester 1-chloroethyl-2,2,3-trimethyl hexanoate from an alcohol and an alkene.