Organic Chemistry Reactions [ch. 1 refer]

Understanding how one type of compound can be changed into a different compound in a planned procedure using specific catalysts and/or laboratory conditions. Most compounds are derived from simple alkanes.

Alkanes are unreactive but they can be made to react using the highly reactive halogens. Once the halogen has been substituted onto the carbon chain, it provides a site for further reactions to occur. (just like a double bond)

Alkane to Haloalkane

Add X_2 and heat (Δ) or light (hv)

$$CH_3CH_3 + Br_2 \xrightarrow[\Delta]{hv} CH_3CH_2Br + HBr$$

Actual reaction is a chain reaction…

$Br_2 \rightarrow Br\bullet + Br\bullet$ Initiation

$Br\bullet + CH_3CH_3 \rightarrow CH_3CH_2\bullet + HBr$

$Br_2 + CH_3CH_2\bullet \rightarrow CH_3CH_2Br + Br\bullet$

$Br\bullet + CH_3CH_2\bullet \rightarrow CH_3CH_2Br$

Propagation

$Br + Br \rightarrow Br_2$

$CH_3CH_2\bullet + CH_3CH_2\bullet \rightarrow CH_3CH_2CH_2CH_3$

Termination

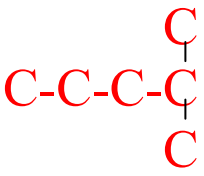
Overall $CH_3CH_3 + Br_2 \rightarrow CH_3CH_2Br + HBr + CH_3CH_2CH_2CH_3$

And if larger alkanes are used the types of products that are formed increase in diversity…

Ex.

$CH_3CH_2CH_3 + Br_2 \rightarrow CH_3CHBrCH_3 + CH_3CH_2CH_2Br$
$+ CH_3CH_2CH_2CH_2CH_2CH_3 + HBr$

OR



→ messy

Organic compounds can be separated by their physical properties such as boiling point or solubility. The polarity of the molecule is related to the physical properties. More details are found throughout the textbook - ch.1

Haloalkane → Alcohol

Fwd – add dilute OH^-

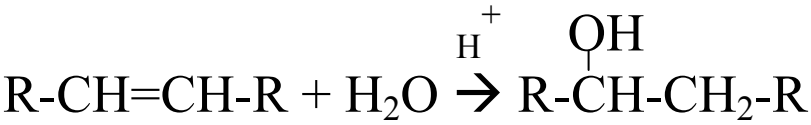
$CH_3CH_2CH_2\text{-}Cl + NaOH_{dil} \rightarrow CH_3CH_2CH_2\text{-}OH + NaCl$

Rev – Add HX and Δ

$$CH_3\underset{\underset{OH}{|}}{C}HCH_3 + HCl \xrightarrow[\Delta]{HX} CH_3\underset{\underset{Cl}{|}}{C}HCH_3 + H_2O$$

Alkene → Alcohol

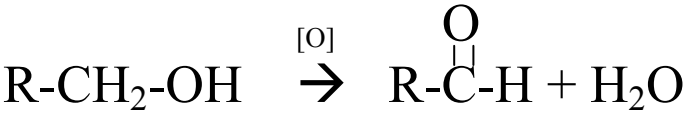
Add acidified water



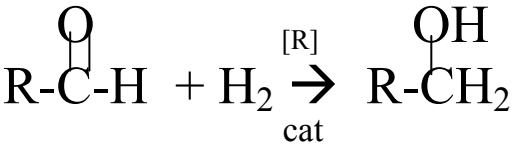
Markovnikov's Rule – The OH^- (or any –ve ion) attaches to the carbon with the most other carbons attached to it. (at the reaction site) or H's go to the carbon with more H's.

Alcohol →Aldehyde

Fwd – add weak oxidizing agent [O] to a 1^o alcohol

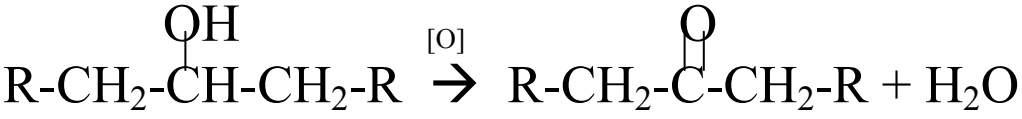


Rev – Add a reducing agent [R] to aldehyde

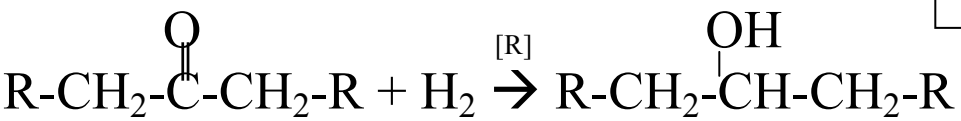


Alcohol → Ketone

Fwd – add [O] to 2^o Alcohol



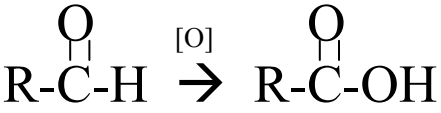
Rev – add [R] to ketone



3^o Alcohols do not oxidize easily

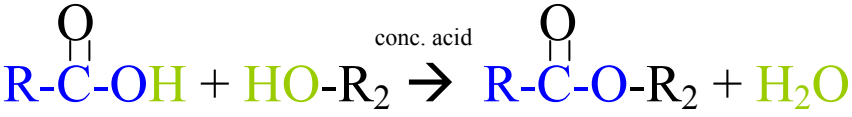
Aldehyde → Carboxylic acid

Add [O]



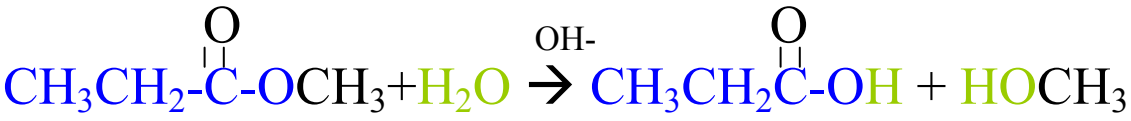
Carboxylic Acid → Ester

Fwd – acid + alcohol → esterification (dehydration)



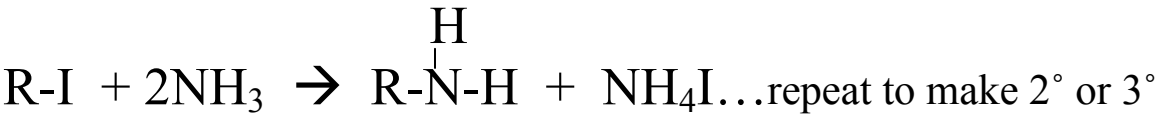
Radioactive isotope labelling

Rev – De-esterification (hydration)



Haloalkane → 1° Amine

Only works with R-I

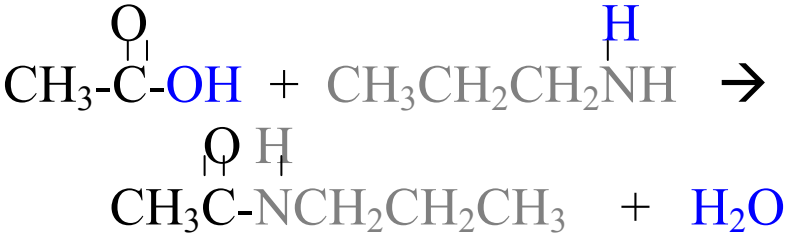


Ester → Amide

add amine to ester

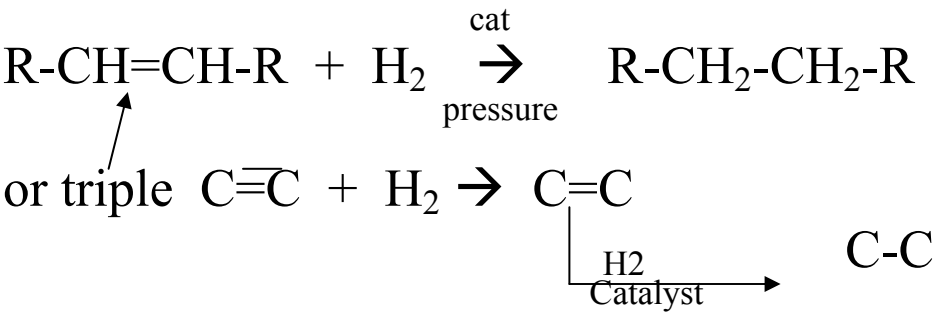
Carboxylic Acid → Amide

Add amine to carboxylic acid



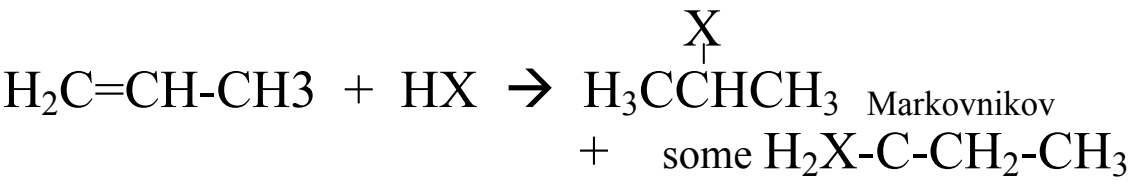
Alkynes→Alkenes or Alkenes→Alkanes

Add H_2, catalyst, pressure

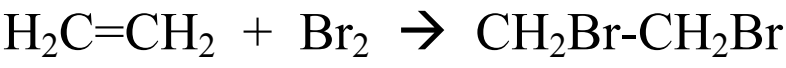


Alkene→Haloalkane

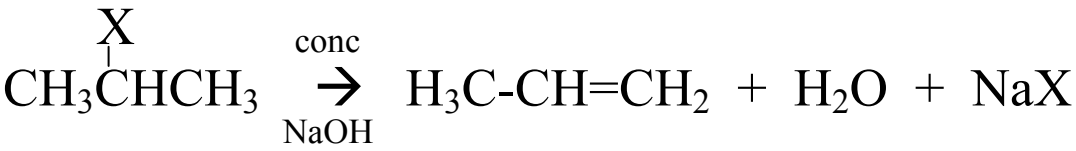
Fwd – add HX



OR

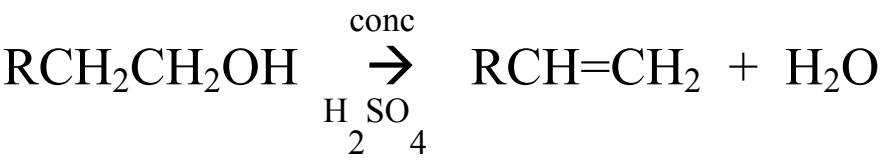


Rev – add conc. OH^-



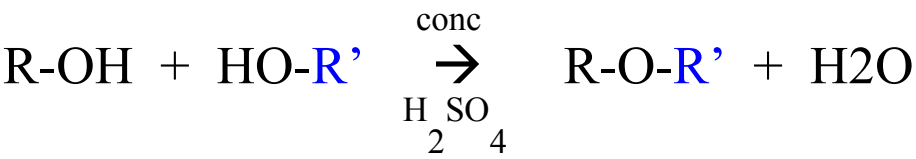
Alcohol → Alkene

Add conc H_2SO_4

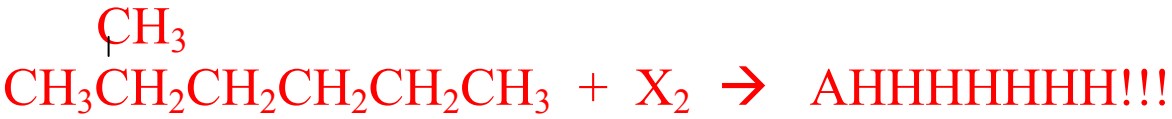


Alcohol → Ether

Mix two alcohols with conc H_2SO_4 as a dehydrating agent



These reactions are but a few organic chemistry reactions with simple reactants. The longer the chain the more products that can occur. Organic chemistry is messy!



Modify your flow chart to include all of these reactions

Knowing the reactants that you start with and the products you need to make will help you find the pathway (or steps) you need to follow

Example problems and solutions are throughout the textbook