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Alcohols, Esters and Carboxylic acids

→ Alcohols

→ OH functional group

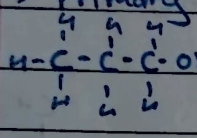
→ general formula - $C_nH_{2n+1}OH$

→ used as fuel, it combusts very well.

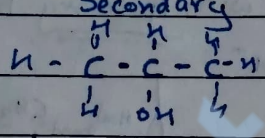
→ very volatile

→ very good solvent (Ethanol)

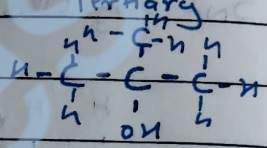
→ Primary



Secondary



Tertiary



The carbon attached to the OH group is attached to how many carbons

→ Combustion of alcohol

→ $CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

→ Formation of haloalkanes from alcohols by substitution

→ using PCl_3, condition - Heat

$3CH_3CH_2OH + PCl_3 \rightarrow 3CH_3CH_2Cl + H_3PO_3$

→ using PCl_5

$CH_3CH_2OH + PCl_5 \rightarrow CH_3CH_2Cl + POCl_3 + HCl$

→ using $SOCl_2$

$CH_3CH_2OH + SOCl_2 \rightarrow CH_3CH_2Cl + SO_2 + HCl$

SO_2 (g), HCl (g)

→ using HCl

Step1 - $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

Step2 - $CH_3CH_2OH + HCl \rightarrow CH_3CH_2Cl + H_2O$

→ Alcohol + sodium metal

$2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2ONa + H_2$

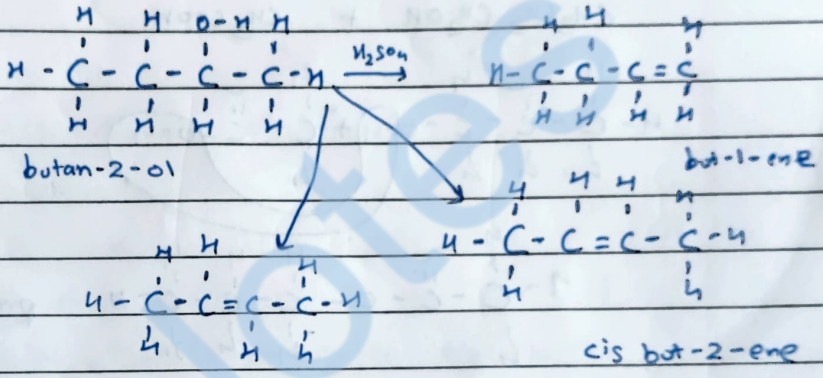
$CH_3CH_2O^-$ ethoxide ion Na^+ sodium ion

→ Alcohol dehydration.

Condition - Concentrated H_2SO_4 as catalyst.

$CH_3CH_2OH \xrightarrow{H_2SO_4} CH_2=CH_2 + H_2O$

Example.



⇒ Carboxylic Acid

→ COOH functional group

→ general formula - $C_nH_{2n}O_2$

→ Formation of a carboxylic acid

→ oxidation of primary alcohol

→ oxidation of an aldehyde

→ ↑ acidic hydrolysis of nitrile (CN)

→ $CH_3CN + 2HCl + 2H_2O \rightarrow CH_3CO_2H + NH_4Cl$

→ condition Aqueous HCl and Heat

→ Carboxylic acid reactions

1. Carboxylic + metal → Salt + H_2

$2CH_3CH_2CO_2H + Na \rightarrow 2CH_3CH_2CO_2Na + H_2$

2. Carboxylic + alkali → Salt + H_2O

$2CH_3CH_2CO_2H + NaOH \rightarrow CH_3CH_2CO_2Na + H_2O$

3. Carboxylic + metal carbonate → Salt + CO_2 + H_2O

$2CH_3CH_2CO_2H + MgCO_3 \rightarrow (CH_3CH_2CO_2)_2Mg + CO_2 + H_2O$

→ reduction of carboxylic acids (gives alcohol)

using $LiAlH_4$ in dry ether

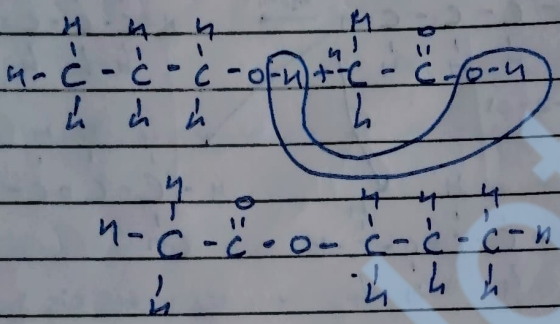
$CH_3CH_2CO_2H + 4[H] \rightarrow CH_3CH_2CH_2OH + H_2O$

→ Esterification

Alcohol + carboxylic → Ester + H_2O

condition → Heat, concentrated H_2SO_4 as catalyst

$CH_3CH_2CH_2OH + CH_3COOH$



propyl ethanoate

Esters are used as solvents, shampoos and in flavorings.

general formula for Ester - $C_nH_{2n}O_2$

Esters can form functional isomers with carboxylic acid.

→ Hydrolysis of esters

→ Acid hydrolysis

$CH_3CO_2CH_2CH_2CH_3 + H_2O \rightarrow CH_3CO_2H + CH_3CH_2CH_2OH$

Carb — Alcohol

→ Alkaline hydrolysis

$CH_3CO_2CH_2CH_2CH_3 + NaOH \rightarrow CH_3CO_2Na + CH_3CH_2CH_2OH$

Salt — Alcohol