CHM 102

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Mechanical Engineering
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1.) Classification Of Alkanols

- Classification based on the number of alkyl groups or hydrogen atom

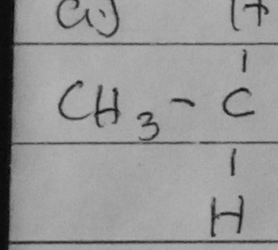
Alkanol has the general formular "R-OH", here "R" is the alkyl group e.g methyl - CH_3

Ethyl - CH_3CH_2

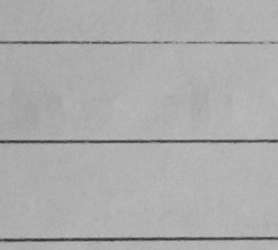
Propyl - $CH_3CH_2CH_2$

While 'OH" is the hydroxyl group which is the main functional group of alkanols, they are classified as follows

i) Primary alkanol: They have only one alkyl group or three or two hydrogen atom attached to the atom that carries hydroxyl group e.g

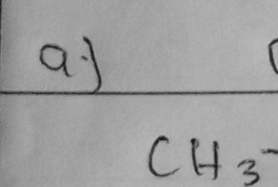
a) 

Ethanol (1°)

b.) 

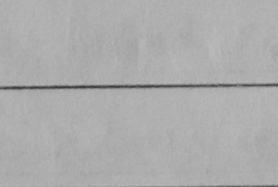
Methanol (1°)

ii) Secondary alkanol: Secondary alkanols have two alkyl groups or one hydrogen atom attached to the carbon that carries the hydroxyl group e.g

a) 

Propan-2-ol (2°)

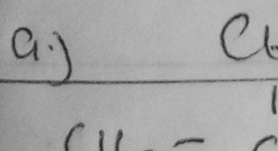
2-Propanol (2°)

b.) 

2-Butanol (2°)

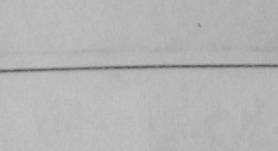
Butan-2-ol (2°)

iii) Tertiary alkanol: Tertiary alkenol have three alkyl group and no hydrogen atom attached to the carbon atom that carries the hydroxyl group

a.) 

2 methyl Propan-2-ol (3°)

2 methyl-2-Propanol

b.) 

2-methyl Butan-2-ol

2-methyl-2-Butanol

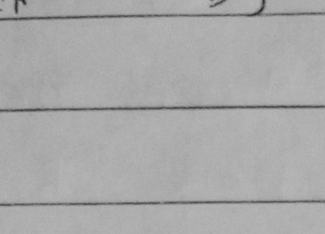
2.) Classification based on the number of hydroxyl groups they possess. It can be classified as follows

i.) Monohydric alkanols: Monohydric alkanols have only one hydroxylic group (-OH) present in the alkanol structure e.g

a.) $CH_3CH_2CH_2OH$

Propanol

b.)



Ethanol

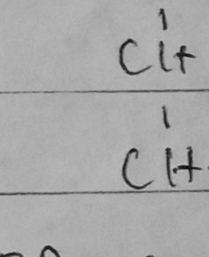
ii.) Dihydric alkanols: Dihydric alkanol are also called glycols having two hydroxyl group present in the alkanol groups present in the alkanols structure e.g

$CH_3CH(OH)CH_2CH(OH)CH_2CH_3$

Hexane-2-4 diol (Dihydric alkanols)

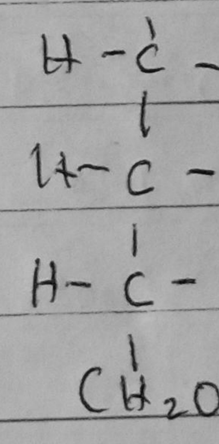
iii.) Trihydric alkanol: They are also called triols, they have three hydroxyl groups present in the alkanol structure e.g

a.)



Propane-1,2,3 triol (Trihydric alkanols)

b)



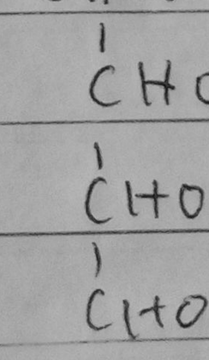
D-glyceral aldehyde

iv.) ~~Polyhydric~~ Polyhydric alkanols: Polyhydric alkanols or Polyols are those ones having more than three hydroxyl group e.g

a.) $CH_3CH(OH)CH(O)CH(OH)CH(OH)CH(OH)CH_3$

Heptane-2,3,4,5,6- Pentanol

b.)



L-(-)-Talose

2) In the grignard's Synthesis of alkanols, react grignard's reagent with $CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3$ Show the reaction step

$CH_3CH_2CH_2MgCL$ + $CH_3CH_2CH_2CH_2C=OCH_2CH_2$

Propyl Magnesium Chloride (Grignard reagent)

Octan-4-none

$CH_2CH_2CH_3$

$CH_3CH_2CH_2MgCL$ + $CH_3CH_2CH_2CH_2$

diethyle ether

$CH_2CH_2CH_3$

$CH_3CH_2CH_2-C-O-MgCL$

$CH_2CH_2CH_2CH_3$

H^+ OH^-

$CH_3CH_2CH_2-C-OH$ + $Mg(OH)Br$

$CH_2CH_2CH_2CH_3$

4-Propyl Octan-4-OL

Magnesium hydroxyl Bromide

3) Carbohydrates such as Starch are major group of natural compound that can be made to yield ethanol by the biological process of fermentation. The biological catalyst (enzymes) found in yeast break down the carbohydrate into ethanol to yield 95%. The Starch containing materials include Molasses, Potatoes, cereal, rice and corn On warming with malt to 60°C for a specific period of time are converted in maltose by the enzyme diatase contained in malt

$2(C_6H_{10}O_5)n + nH_2O \xrightarrow[60°C/diatase]{} nC_{12}H_{22}O_{11}$

maltose

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 15°C

$C_{12}H_{22}O_{11} + H_2O \xrightarrow[15°C/maltase]{} 2C_6H_{12}O_6$

maltose

The Glucose at constant temperature of 40°C is then converted into alcohol by the enzyme Zymase contained also in the yeast

$$C_6H_{12}O_6 \xrightarrow[\text{Zymase}]{15^{\circ}C} 2CH_3CH_2OH + 2CO_2$$

Glucose — Ethanol

4.)

Alkenols and alkanones are reduced to Primary and Secondary alkenol by hydrogenation of carbon - oxygen double bond in the presence of a catalyst such as Platinum, Nickel, Palladium Catalyst or with Sodium tetra chlorate (III) ($NaBH_4$)

Example: Reduction of an alkenol yield an alkanal are reduced to Primary alkenols' e.g

$$CH_3CH_2CH_2C{=}O + H_2 \xrightarrow{Pt, Ni, Pd} CH_3CH_2CH_2CH_2OH$$

Butanol

- Reduction of an alkanone yield a Secondary alkenol

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_2 + H_2 \xrightarrow{Ni, Pt \text{ or } Pd} CH_3-\overset{OH}{\overset{|}{C}}H-CH_3$$

2 - Propanol — 2 - Propanone