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MAT NO: 19/ENG06/026

CHEM 102

## CHEMISTRY ASSIGNMENT

1) Discuss the two major classifications of Alcohols  
Give two Examples each for each class

There are two major classifications of alcohol which are:

(i) Classification based on the number of alkyl group as hydrogen alone.

Note: Alcohol has the general molecular formula " $R-OH$ " where " $R$ " is the alkyl group e.g

Methyl -  $CH_3-$

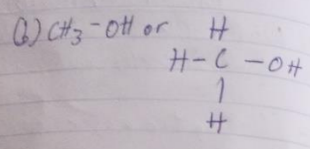
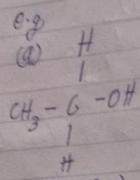
Ethyl -  $CH_3CH_2-$

Propyl -  $CH_3CH_2CH_2-$  etc

While " $-OH$ " is the hydroxyl group which is the main functional group for alcohols.

Therefore based on this classification, alcohols can be classified as follows:

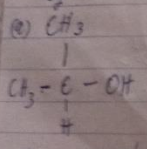
1) Primary alcohol: Primary alcohols have only one alkyl group or three or two hydrogen atoms attached to the carbon atom that carries hydroxyl group



Ethanol ( $1^\circ$ )

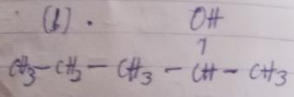
Methanol ( $1^\circ$ )

(ii) Secondary alcohol: Secondary alcohols have two alkyl groups or one hydrogen atom attached to the carbon that carries the hydroxyl group.



Propan-2-ol ( $2^\circ$ )

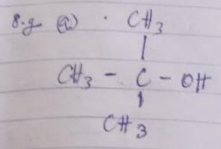
or  
2-Propanol ( $2^\circ$ )



2-Butanol ( $2^\circ$ )

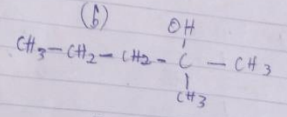
or  
Butan-2-ol ( $2^\circ$ )

(iii) Tertiary alcohol: Tertiary alcohols have three alkyl groups and no hydrogen atoms attached to the carbon atom that carries the hydroxyl group.



2-methyl propan-2-ol ( $3^\circ$ )

or  
2-methyl-2-Propanol ( $3^\circ$ )



2-methyl butan-2-ol

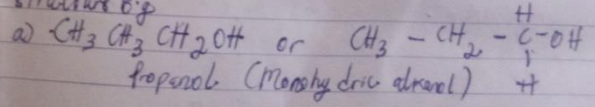
or  
2-methyl-2-Butanol

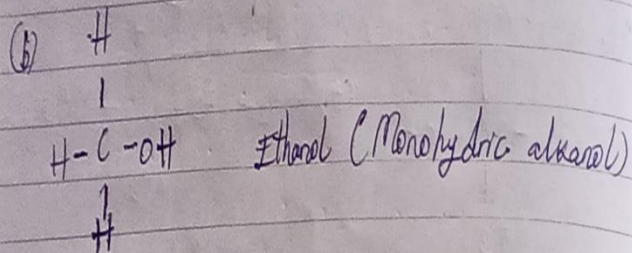
(iv) Classification based on the number of hydroxyl groups they possess

Note: The hydroxyl group has a general formula  $\text{-OH}$ .

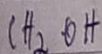
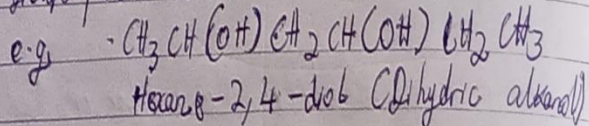
Therefore based on this classification, alcohols can be classified as follows

(i) Monohydric alcohols: Monohydric alcohols have only one hydroxyl group ( $\text{-OH}$ ) present in the alcohol structure e.g.



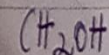


(ii) Dihydric alcohols: Dihydric alcohol are also called Glycols have two hydroxyl group present in the alcohol structure.

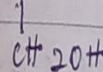
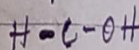
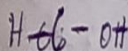
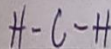
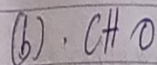


Ethane-1,2-diol (Dihydric alcohol)

(i) Trihydric alcohol: Trihydric alcohol or triols are alcohols that have three hydroxyl groups present in the alcohol structure. e.g. (a)

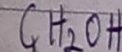
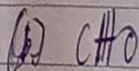
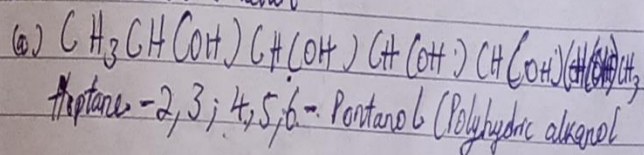


Propane-1,2,3-triol (Trihydric alcohol)



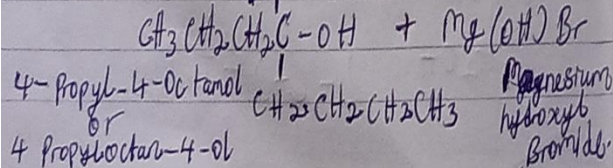
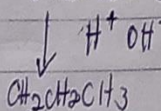
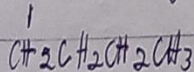
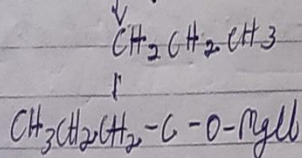
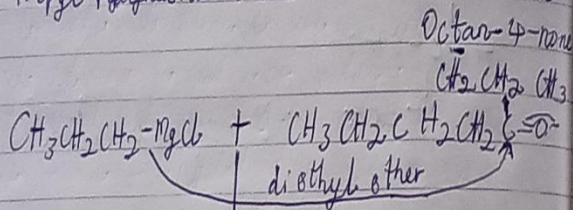
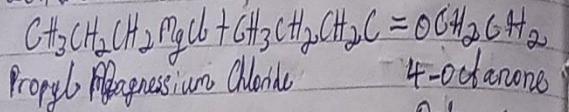
$\text{CH}_2\text{OH}$  D-glyceraldehyde

(iv) Polyhydric alcohols: Polyhydric alcohols or polyols are those alcohols having more than three hydroxyl groups in the alcohol structure



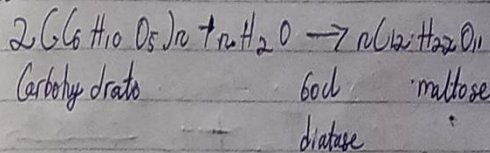
L-(-)-Talose

2) In the Grignard synthesis of Alcohols, react a named Grignard reagent with  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCH}_2\text{CH}_2\text{CH}_3$ . Show the reaction steps.

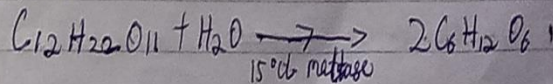


3) Discuss the Industrial manufacture of ethanol showing all the reactions equations and necessary enzymes and temperature of reaction.

Carbohydrates such as starch are major group of natural compounds that can be made to yield ethanol by the biological process of fermentation. The biological catalysts enzymes found in yeast break down the carbohydrate molecule into ethanol to give a yield of 95%. The starch containing materials include molasses, potatoes, cereals, rice and are warming with malt to  $60^\circ\text{C}$  for a specific period of time, are converted in maltose by the enzyme diastase contained in malt.

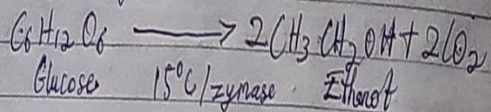


The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of  $15^\circ\text{C}$ .



The glucose at constant temperature of  $15^\circ\text{C}$  is then converted into alcohol (ethanol) by the enzyme Zymase

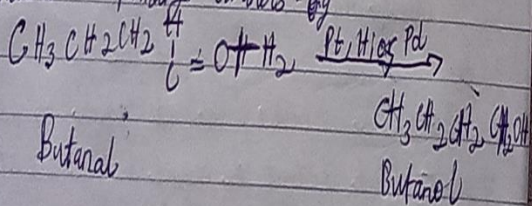
contained also in yeast.



4) Determine the product obtained, used in the reduction of Alkanone and Alkanal. Use a specific example for each and show the equation of reaction.

Alkanals and alkanones are reduced to primary and secondary alkanol by hydrogenation of carbon-oxygen double bond in the presence of a catalyst such as platinum ( $\text{Pt}$ ), nickel ( $\text{Ni}$ ), Palladium ( $\text{Pd}$ ) catalyst or sodium borohydride ( $\text{NaBH}_4$ ) ( $\text{H}$ ) ( $\text{NaBH}_4$ )

Examples (i) Reduction of an alkanal yields an alkanol are reduced to primary alkanols - eg



(ii) Reduction of an alkanone yields a secondary alkanol

