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DEPARTMENT: PETROLEUM ENGINEERING

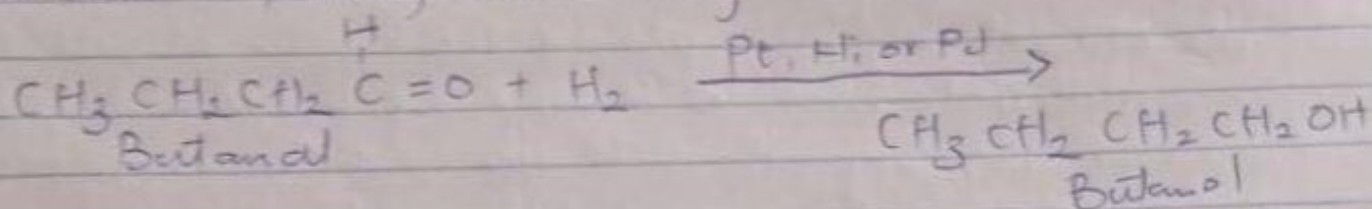
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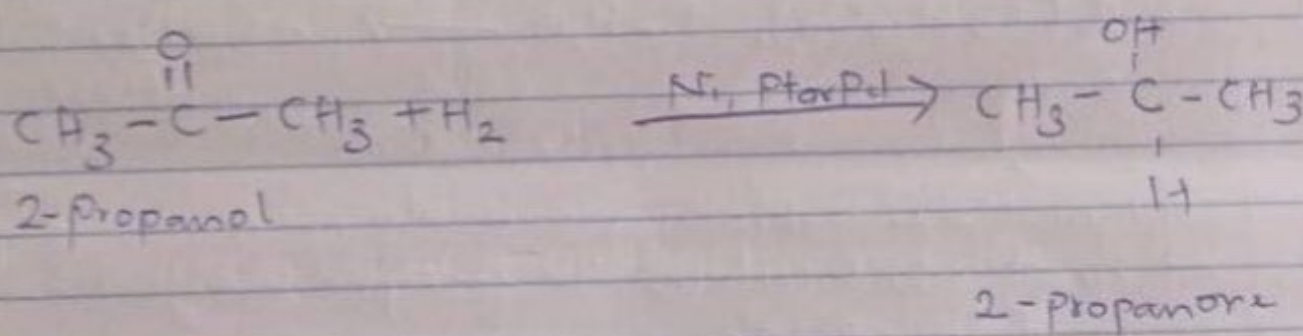
N.U.E.S.

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 (Pt), nickel (Ni), Palladium (Pd) catalyst or with sodium tetrahydride (III) (NaBH_4).

Examples: (i) Reduction of an alkanal yields a primary alkanol e.g

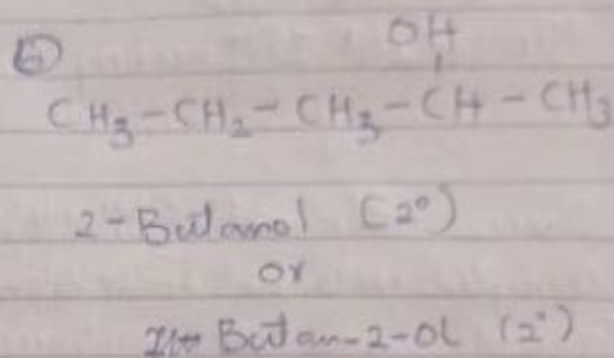
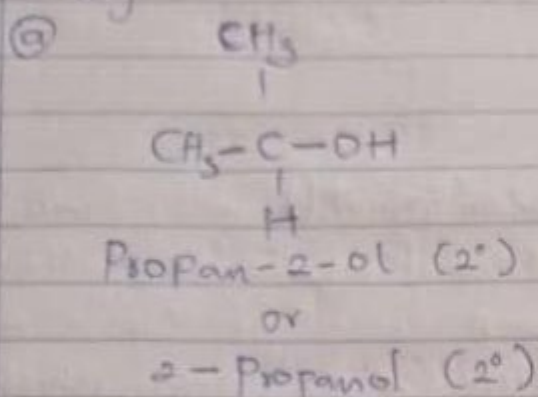


(ii) Reduction of an alkanone yields a secondary alkanol e.g



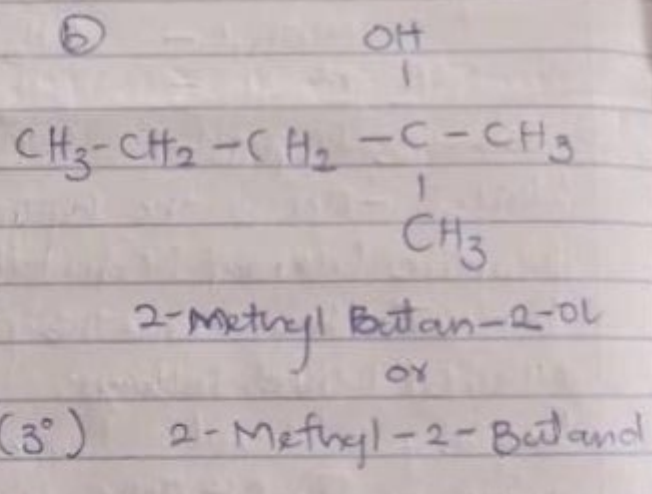
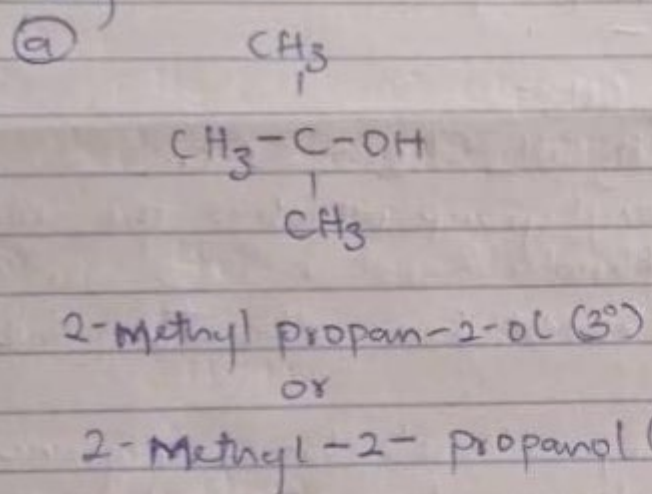
carries the hydroxyl group.

e.g.



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

e.g.



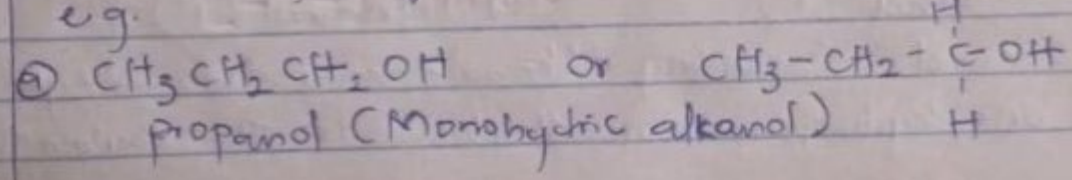
2 Classification based on the number of hydroxyl groups they possess.

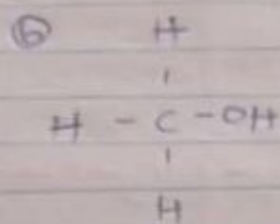
Note: The hydroxyl group has a general formula "-OH".

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

i Monohydric alcohols: Monohydric alcohols have ^{only} one hydroxyl group (-OH) present in the alcohol structure.

e.g.

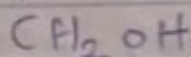
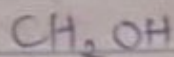
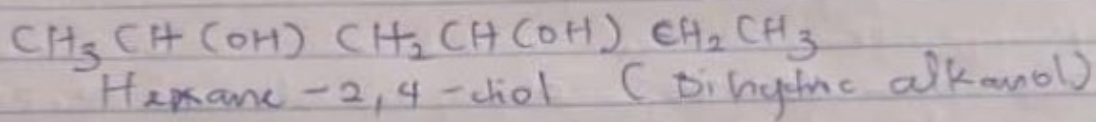




Ethanol (Monohydric alcohol)

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

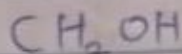
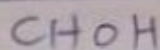
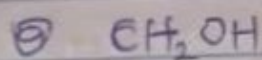
eg



Ethane-1,2-diol (Dihydric alcohols)

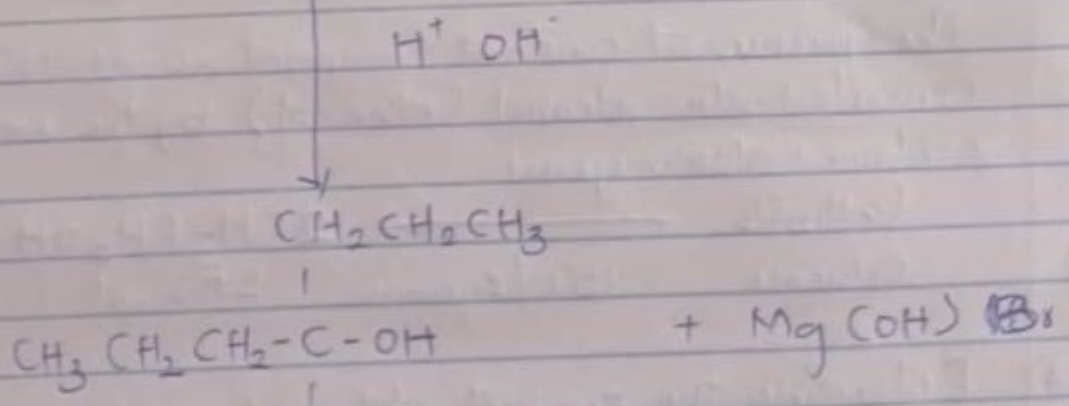
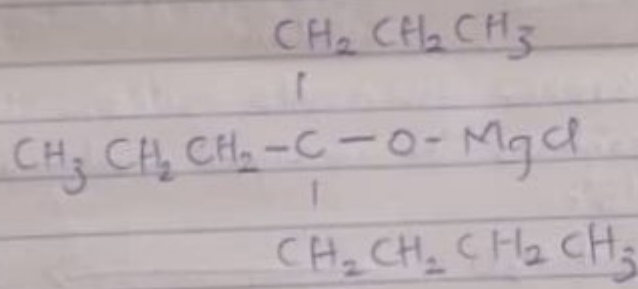
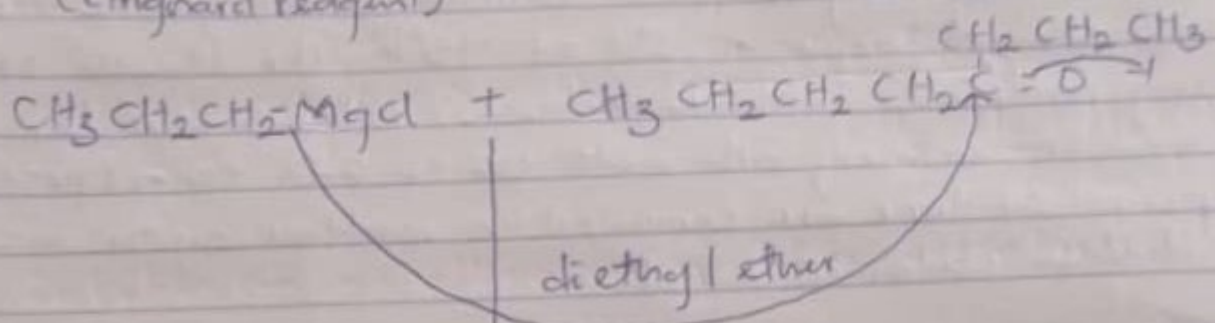
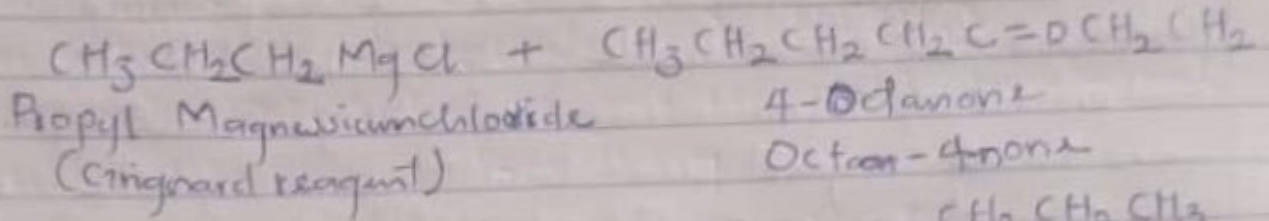
iii Trihydric alcohol: Trihydric alcohol or triols are alcohols that have three hydroxyl groups present in the alcohol structure.

eg



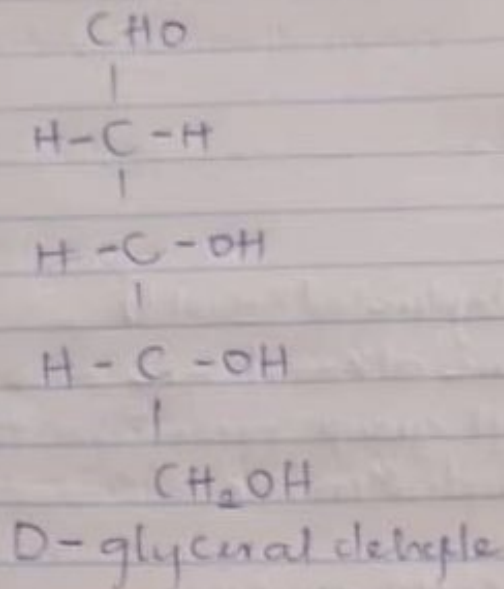
Propane-1,2,3-triol (Trihydric alcohol)

2 In the Grignard synthesis of alkanols, react a named Grignard reagent with $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{C}=\text{OCH}_2\text{CH}_2\text{CH}_3$ $\text{CH}_3\text{CH}_2\text{CH}_2\text{MgCl}$. Show the reaction steps.



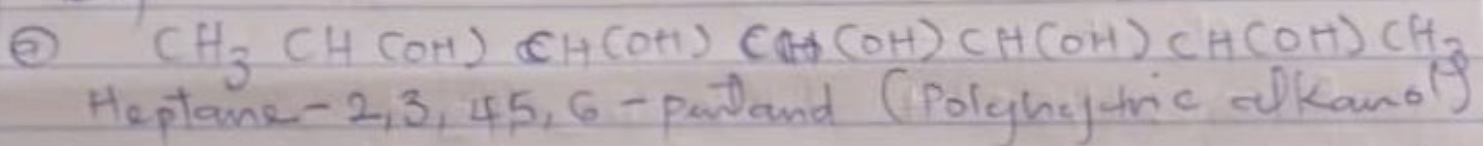
4-Propyl-4-Octanol Magnesium hydroxide
 or Bromide
 4-Propyl Octan-4-ol

⑥

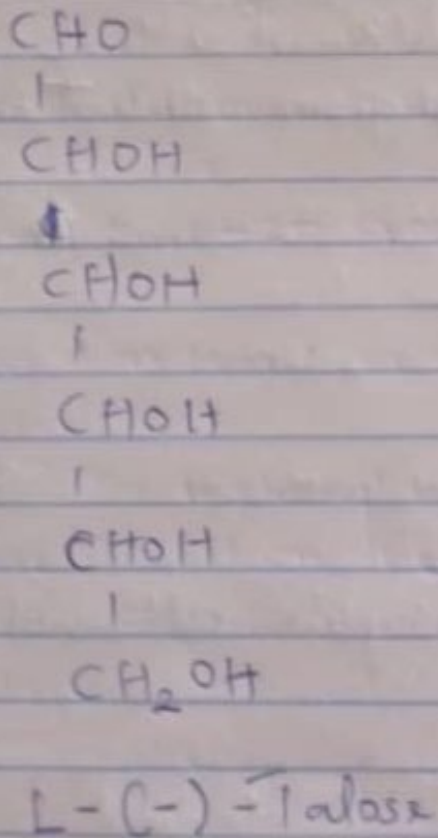


1- Polyhydric alcohols: Polyhydric alcohols or polyols are those alcohols having more than three hydroxyl groups in the alcohol structure.

e.g.

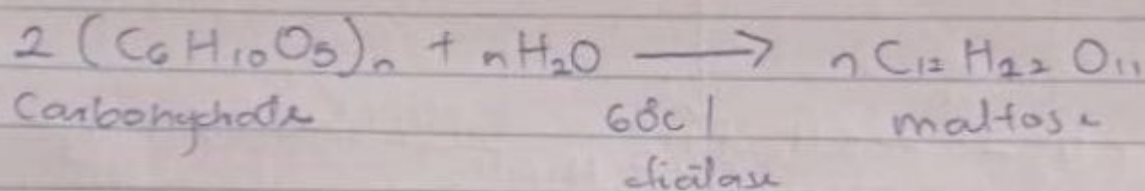


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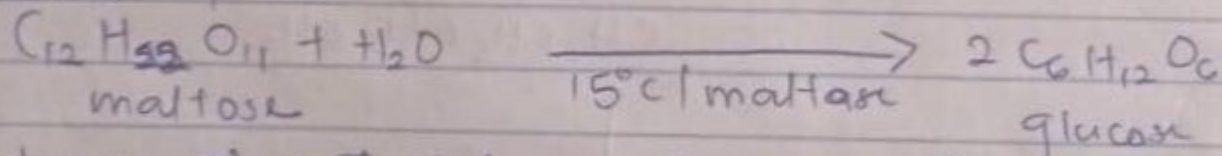


5 Discuss the industrial manufacture of ethanol showing all the reactions equations and necessary enzymes and temperature of reaction.

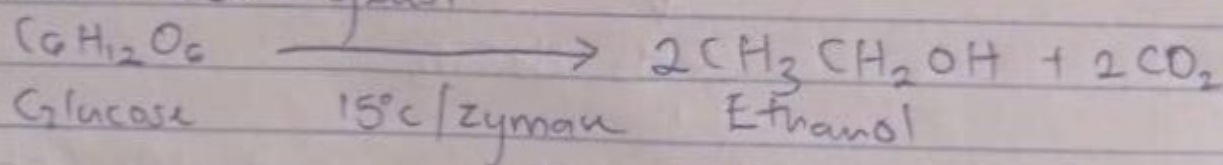
Carbohydrates such as starch are major group of natural compounds that can be made to yield ethanol by the biological process of fermentation. The biological catalysts, enzymes found in yeast break down the carbohydrate molecules into ethanol to give a yield of 95%. The starch containing materials include molasses, potatoes, cereals, rice and on warming with malt ~~to~~ to 60°C for a specific period of time are converted to 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°C.



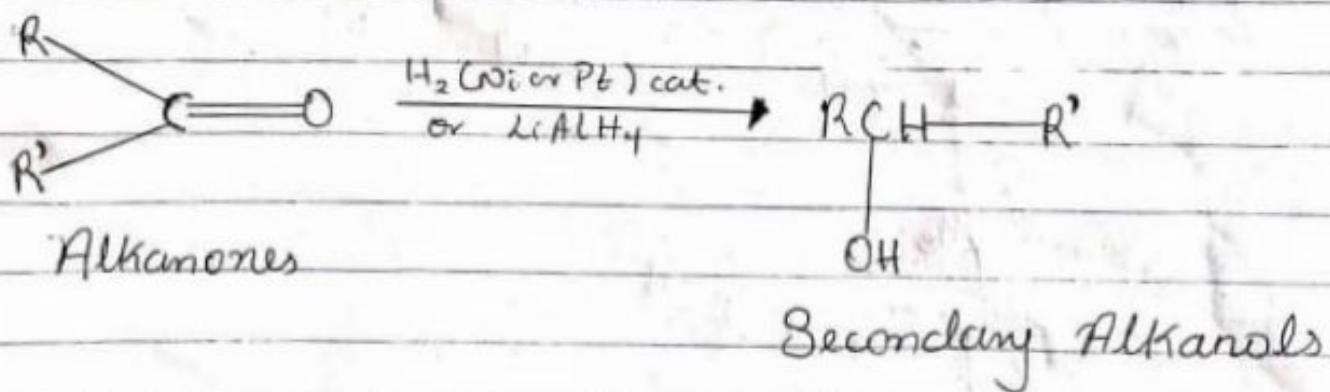
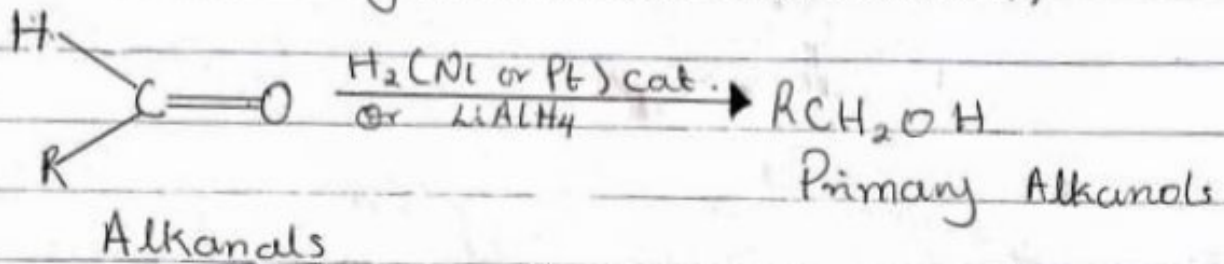
The glucose at constant temperature of 15°C is then converted into alcohol (ethanol) by the enzyme Zymase contained also in yeast.



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.

4 Reduction of Alkanones and Alkanals

Alkanals and Alkanones are reduced to primary and secondary Alkanols respectively by reaction with hydrogen in the presence of a platinum or nickel catalyst or with aluminium isopropoxide (the Meerwein-Ponndorf reaction) or with complex metal hydride, such as lithium tetrahydridoaluminate (III) (LiAlH_4) or sodium tetrahydridoborate (III) (NaBH_4).



Specific Examples;

