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MECHANICAL ENGINEERING

19/ENG06/016

CHM 102 ASSIGNMENT

1. Discuss the two major classification of Alkanols. Give two examples each for each class.

Answer

There are 2 major ways to classify alcohols (alkanols),

A. Based on the number of hydrogen atoms ~~are~~ attached to the carbon atom containing the hydroxyl group. There are three types under this classification;

(i) Primary Alcohols (1°) - if the number of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two, it is called a primary alcohol. Examples are; CH_3OH (Methanol), $\text{CH}_3\text{CH}_2\text{OH}$ (Ethanol)

(ii) Secondary Alcohols (2°) - if the number of hydrogen atom attached to the carbon atom bearing the hydroxyl group is one, it is called a secondary alcohol. Examples are; $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ (Propan-2-ol), $\text{CH}_3-\text{CH}_2-\text{CH}_2-\underset{\text{OH}}{\text{C}}-\text{CH}_3$ (Butan-2-ol)

(iii) Tertiary Alcohols (3°) - If there are no hydrogen atom attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol. Examples are; $(\text{CH}_3)_3\text{C}-\text{OH}$ (tert-butanol), $\text{CH}_3-\text{CH}_2-\text{CH}_2-\underset{\text{CH}_3}{\overset{\text{OH}}{\text{C}}}-\text{CH}_3$ (2-methylbutan-2-ol)

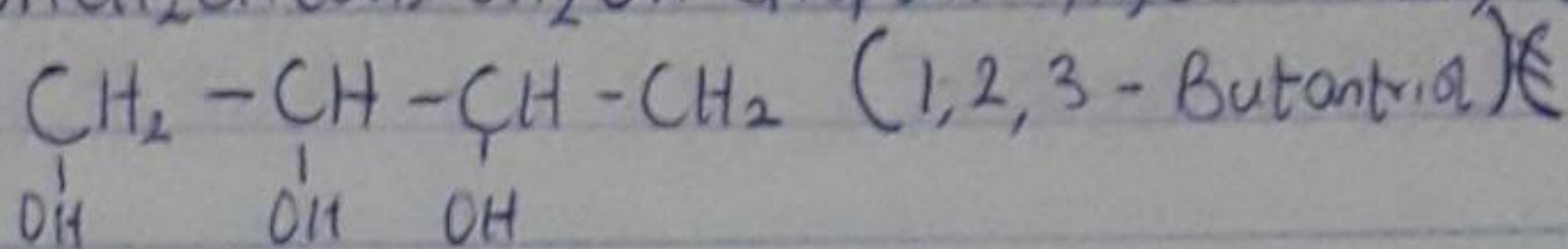
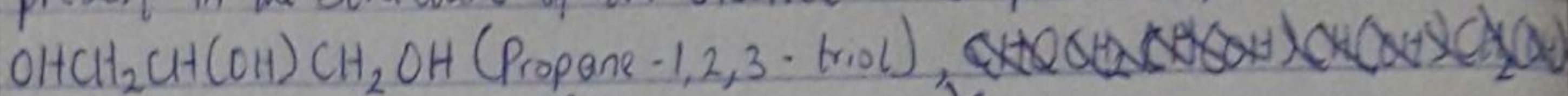
B. Based on the number of hydroxyl groups they possess. There are four types under this classification;

(i) Monohydric Alcohols - They have only one hydroxyl group present in the alcohol structure. Examples are; $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (Propanol), CH_3OH (methanol)

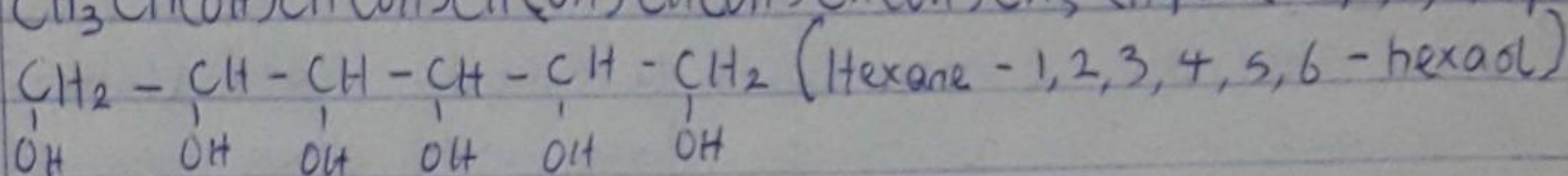
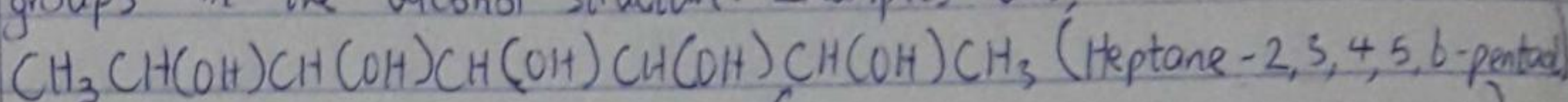
(ii) Dihydric Alcohols (Glycols) - They have two hydroxyl groups present in the alcohol structure. Examples are; $\text{HOCH}_2\text{CH}_2\text{OH}$ (Ethane-1,2-diol), $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ (Hexane-2,4-diol)

(iii) Trihydric Alcohols (Triols) - They have three hydroxyl groups

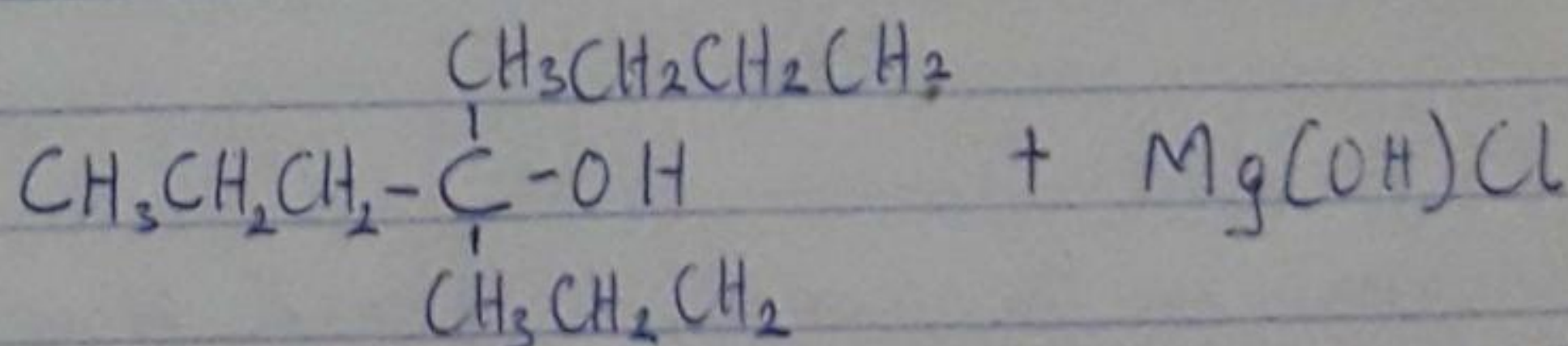
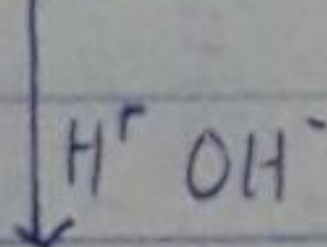
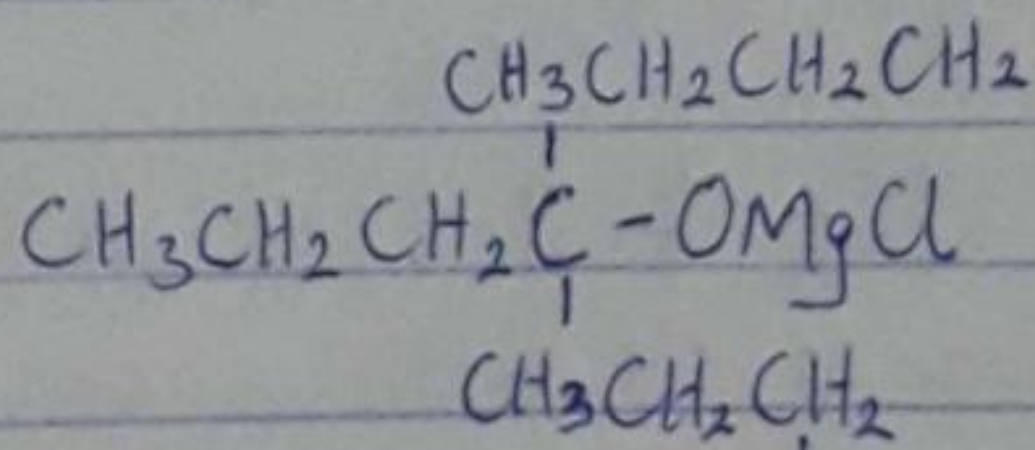
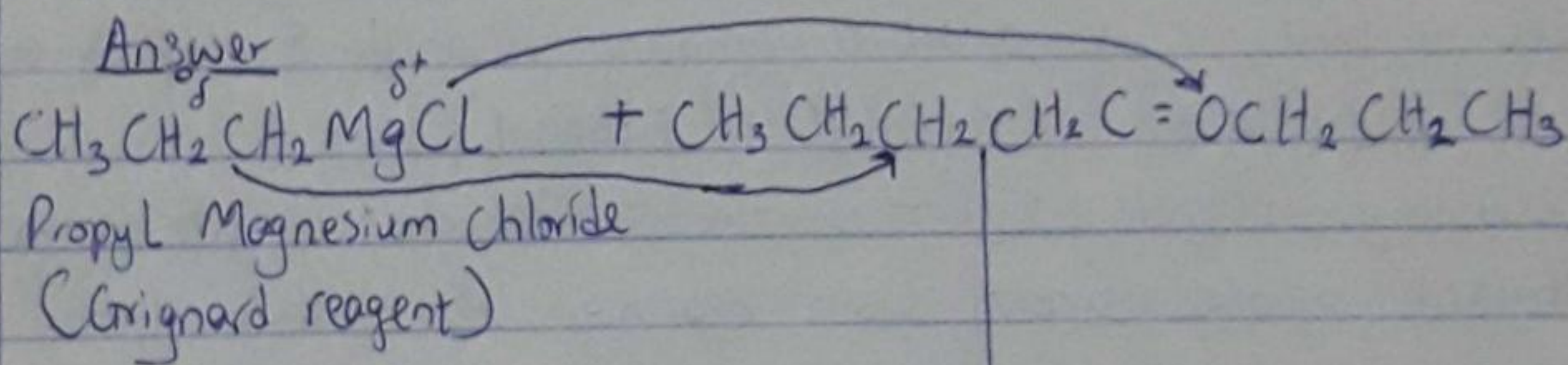
present in the structure of the alcohol. Examples are;



(iv) Polyhydric Alcohols (Polyols) - They have more than three hydroxyl groups in the alcohol structure. Examples are;



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



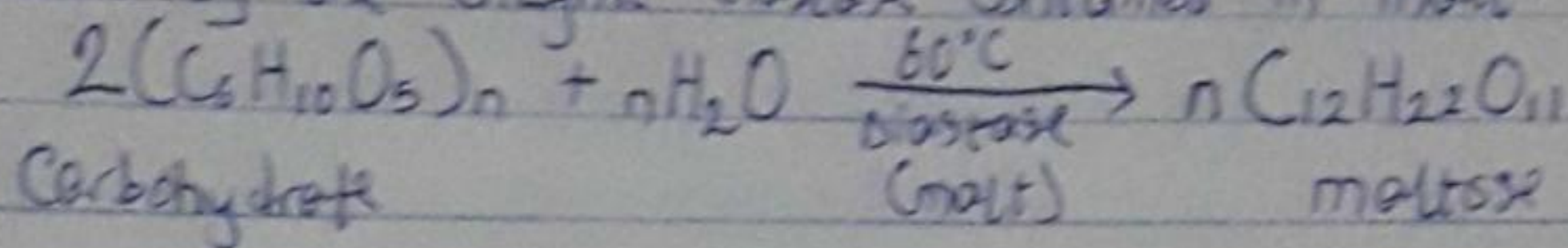
4-propyl-4-Octanol

Magnesium Hydroxyl Chloride

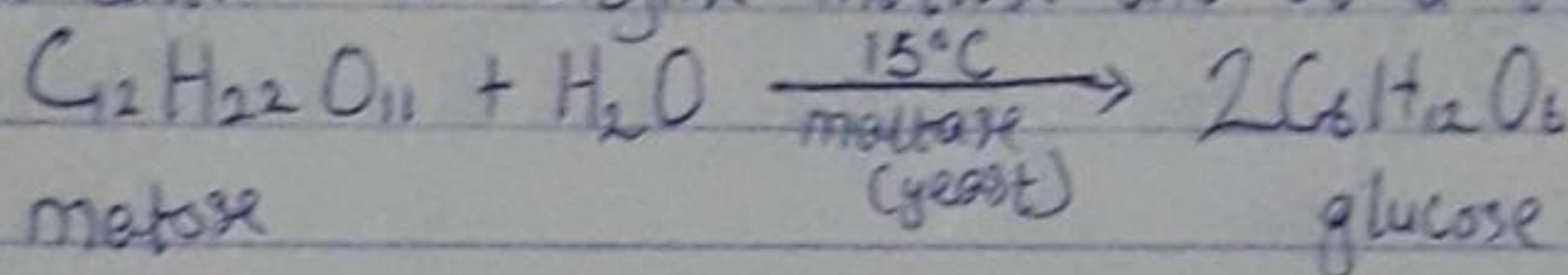
3. Discuss the industrial manufacture of ethanol showing all reaction equations and necessary enzymes and temperature of reaction.

Answer

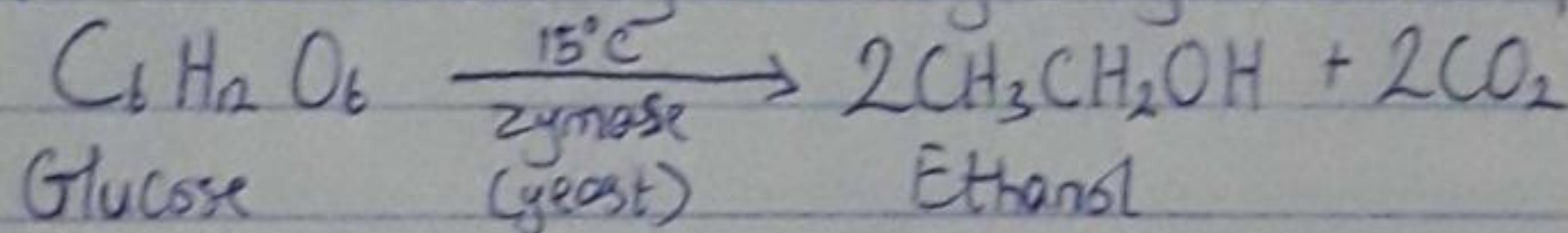
This is done by the biological process of fermentation. Enzymes (biological catalysts) found in yeast break down the carbohydrate molecules into a yield of 95% ethanol. The starch containing materials (molasses, potatoes, cereals, rice) on warming with malt to 60°C for a specific period of time are converted into 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.



At a constant temperature of 15°C, the glucose is then converted into alcohol by the enzyme zymase also found in yeast.



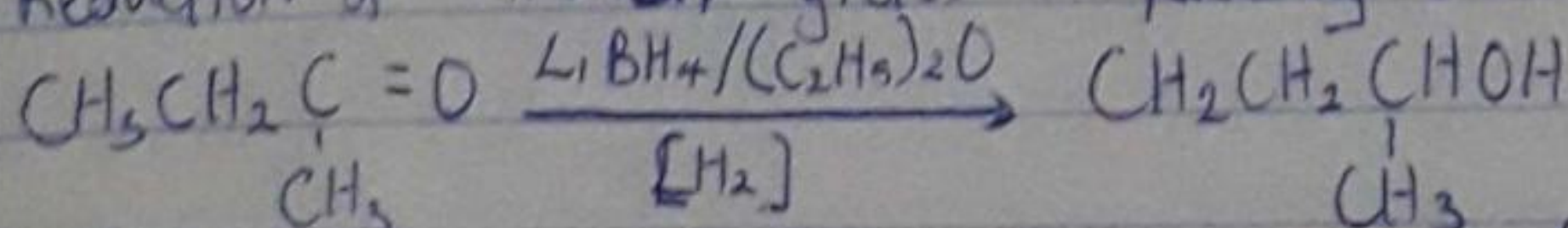
The carbon dioxide is given off into the atmosphere.

4. Determine the product obtained in the reduction of alkanone and alkanol. Use a specific example for each and show the equation of reaction.

Answer

Alkanols and alkanones are reduced to primary and secondary alkanols (alcohols) by the usual reducing agents such as lithiumtetrahydridoaluminate III in ethoxyethane $[LiAlH_4/(C_2H_5)_2O]$, lithiumtetrahydridoborate III in ethoxyethane $[LiBH_4/(C_2H_5)_2O]$ and sodiumtetrahydridoborate III in water or methanol. E.g

* Reduction of alkanone yields a ^{secondary} alcohol:



Butanone

Butan-2-ol

• Reduction of alkanal yields a primary alcohol;

