

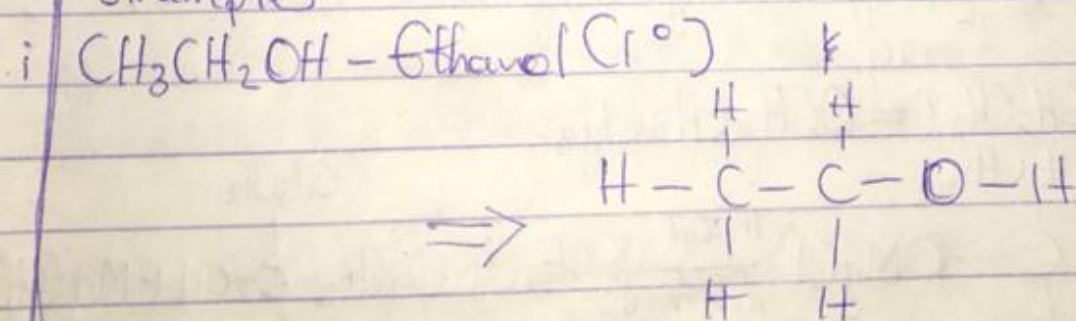
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MATRIC NUMBER: 19/MHSC1/387

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

a) Classification based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group:

If the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two, it's called a 'primary alkanol ( $1^\circ$ )'. [In a primary alkanol, the hydroxyl group is attached to a primary (or terminal) carbon atom ~~bea~~ in the molecule. It is characterised by  $\text{CH}_2\text{OH}$ ]. If it's one hydrogen atom attached to the carbon atom bearing the hydroxyl group, it is called 'secondary alkanol ( $2^\circ$ )'. [In a secondary alkanol, the  $-\text{OH}$  group is on a secondary carbon atom; ~~bea~~ it's characterised by  $>\text{CHOH}$ ] and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it's called a 'tertiary alcohol ( $3^\circ$ )'. [In a tertiary alkanol, the  $-\text{OH}$  is on a tertiary carbon. It's characterized by  $>\text{C}-\text{OH}$ ].

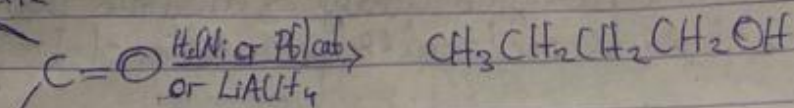
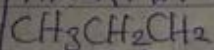
Examples



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

- The reduction of Alkanone and Alkanal  
Using MERRING-PONNORF REACTION

o ALKANAL

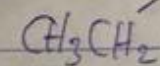
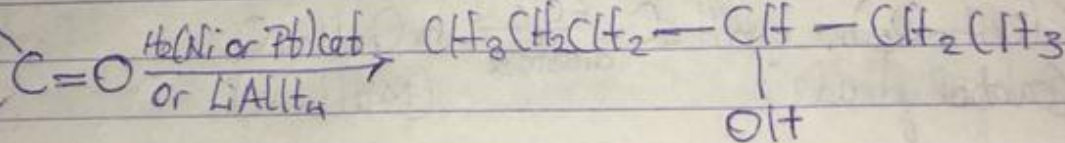
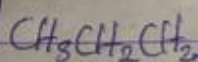


(Butanal)

(Butanol)

The reaction above shows the reduction of an alkanal [e.g. Butanal] to an alkanol [e.g. Butanol].

o ALKANONE



(Hexan-3-one)

(Hexan-3-ol)

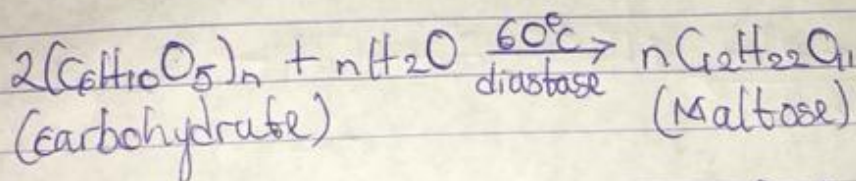
The reaction above shows the reduction of an alkanone [e.g. Hexan-3-one] to an alkanol [e.g. Hexan-3-ol].

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

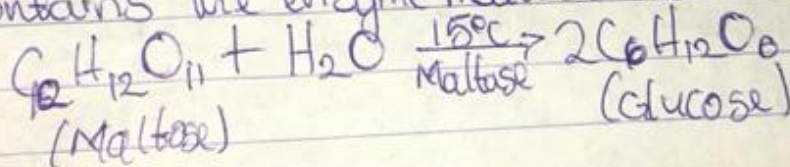
### Industrial manufacture of Ethanol

Carbohydrates such as starch are major groups 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 from ethanol to give a yield of 95%.

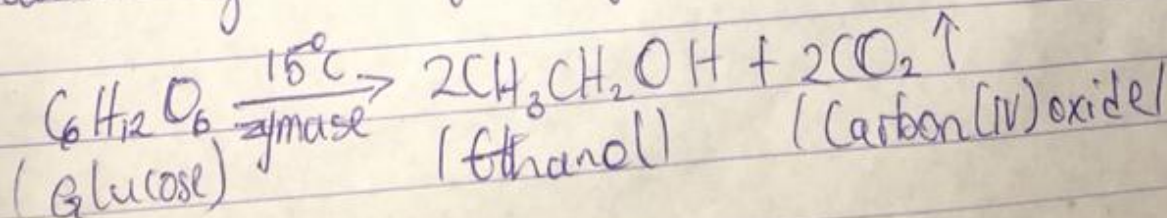
Step 1: The starch containing materials include molasses, potatoes, cereals, rice and on warming with malt to  $60^{\circ}\text{C}$  for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.



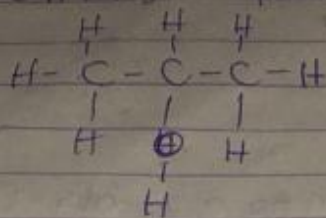
Step 2: The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of  $15^{\circ}\text{C}$ .



Step 3: The glucose at constant temperature of  $15^{\circ}\text{C}$  is then converted into alcohol by the enzyme zymase contained also in yeast



ii  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$  - Propan-2-ol ( $2^\circ$ )



B Classification based on the number of hydroxyl group they possess  
 Monohydric alkanols have only one hydroxyl group per molecule present in the alkanol structure. Dihydric alkanols also called Glycols have two hydroxyl groups present in the alkanol structure while Trihydric alkanols or triols have three hydroxyl group present in the structure of the alkanol. Polyhydric alkanols or polyols have more than three hydroxyl groups

Examples

i  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  - Propanol (Monohydric alkanol)

ii  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$  - Hexane-2,4-diol (Dihydric alkanol)

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

Answers

Grignard reagent:  $\text{CH}_3\text{CH}_2\text{MgCl}$  (ethyl magnesium chloride)

