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Course; Chem 102

Department; MBBG

Matric. No.; 19/MH301/013

Date; 1st April, 2020

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

Answer

Classifications: (i) Based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group, (ii) Based on the number of hydroxyl group they possess.

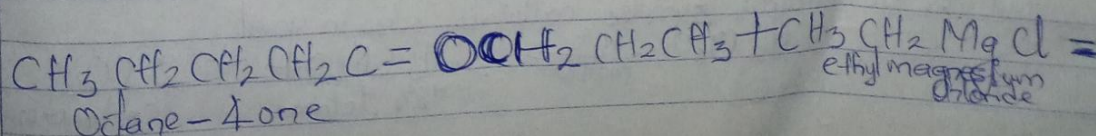
(i) If the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are two or three, it is called a primary alcohol (1°). If it is one hydrogen atom, it is called secondary alcohol (2°) and if there is no hydrogen atom attached to the carbon atom bearing the hydroxyl group, it is called tertiary alcohol (3°).

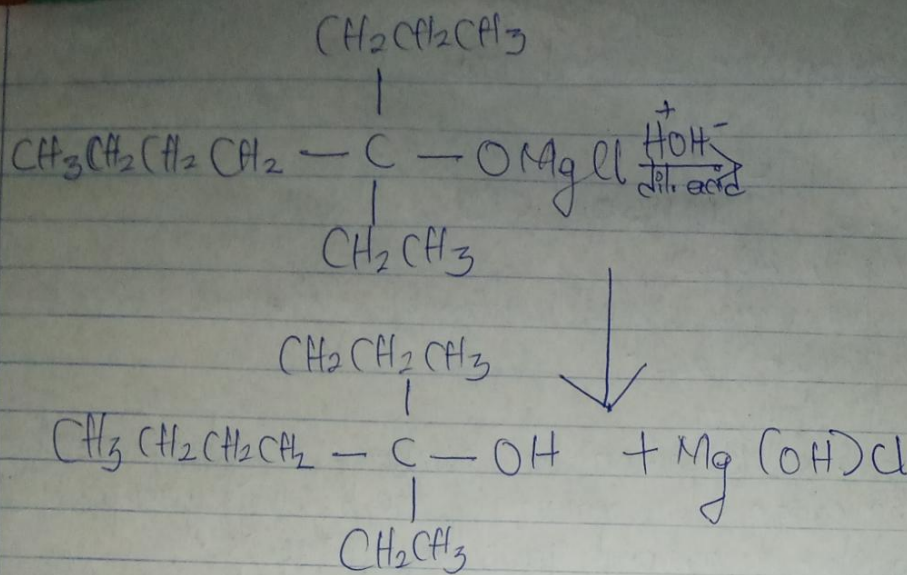
(ii) Alcohols having one hydroxyl group in their alcohol structure are called monohydric alcohols. Dihydric alcohols (also called glycols) have two hydroxyl group present in the alcohol structure while trihydric alcohols or triols have three hydroxyl group present in the alcohol structure. Those having more than three hydroxyl groups are called polyhydric alcohols or polyols.

- 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.

Solution

Using ethylmagnesium chloride ($\text{CH}_3\text{CH}_2\text{MgCl}$)

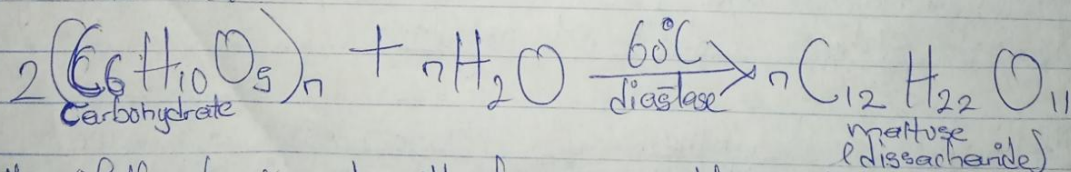




- ③ Discuss the industrial manufacture of ethanol showing all reaction equations and necessary enzymes and temperature of reaction.

Solution

The major group of natural compounds known as carbohydrates such as starch can be made to produce ethanol by the biological process of fermentation. The biological catalysts, enzymes found in yeast breakdown the carbohydrate molecules into ethanol to yield 95% of it. Starch containing materials such as molasses, potatoes, cereals, rice and on warming with malt at 60°C at a specific period of time are converted into maltose by the enzyme diastase present in the malt.



- * Maltose is further broken down into glucose on addition of yeast which contains the enzyme maltase at a temperature of 15°C
- $$\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \xrightarrow[\text{maltase}]{15^\circ\text{C}} 2 \underset{\text{glucose}}{\text{C}_6\text{H}_{12}\text{O}_6}$$

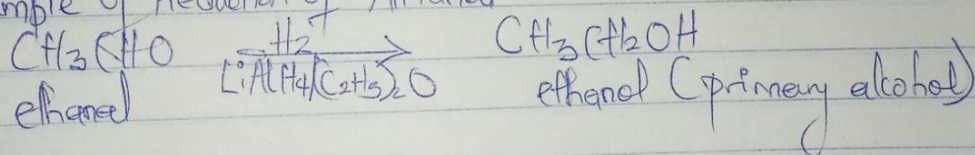
- * The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme zymase, contained also in yeast
- $$\underset{\text{glucose}}{\text{C}_6\text{H}_{12}\text{O}_6} \xrightarrow[\text{maltase}]{15^\circ\text{C}} 2 \underset{\substack{95\% \text{ ethanol}}}{\text{CH}_3\text{CH}_2\text{OH}} + 2 \underset{\text{carbon dioxide}}{\text{CO}_2}$$

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

Solution

- Reduction of alkanone produces a secondary alcohol
- Reduction of alkanal gives a primary alcohol
- Reduction of alkanones and alkanals is done by using reducing agents such as Lithium-tetrahydraluminate (III) in ethoxyethane [$\text{LiAlH}_4 / (\text{C}_2\text{H}_5)_2\text{O}$], Lithium-tetrahydraluminate (III) in ethoxyethane [$\text{LiBH}_4 / (\text{C}_2\text{H}_5)_2\text{O}$], Sodium-tetrahydroborate (III) in water or methanol [$\text{NaBH}_4 / \text{H}_2\text{O}$]

Example of Reduction of Alkanal



Example of Reduction of Alkanone

