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LEVEL: 100L
COURSE: CHE 102

19/MHS01/315

ASSIGNMENT

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

Answer

(i) Based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. We have:

- PRIMARY ALCOHOL (1°): This occurs if the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are two or three

e.g Methanol (CH_3OH)

Petan-1-ol ($CH_3-CH_2-CH_2-CH_2CH_2OH$)

- SECONDARY ALCOHOL (2°): If the numbers of hydrogen atoms attached to the carbon atoms is just one, it is called a secondary alcohol

e.g Propan-2-ol ($CH_3CH(OH)CH_3$)

Pentan-3-ol ($CH_3CH_2\underset{OH}{CH}CH_2CH_3$)

- TERTIARY ALCOHOL (3°): If no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol (3°) e.g Methyl propan-2-ol, methyl-3-pentanol

(ii) Based on the number of hydroxyl groups they posses:

- MONOHYDRIC ALCOHOLS: They have one hydroxyl group present in the alcohol structure

E.g Propanol, Methyl alcohol

- DIHYDRIC ALCOHOLS (GLYCOLS): They have 2 hydroxyl groups present in the alcohol structure

E.g: Ethane-1,2-diol, Hexane-2,4-diol

- TRYHYDRIC ALCOHOLS (TRIOLS): They have 3 hydroxyl group

E.g: Propane-1,2-3-triol

- POLYHYDRIC ALCOHOLS: They have more than 3 hydroxyl groups present in the alcohol structure.

2. In the Grignard synthesis of Alcohols, react a named Grignard reagent with $CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3$ show the reaction steps.

Answer

CH_3CH_2MgCl (Ethyl Magnesium chloride) → Grignard reagent

$$CH_3CH_2MgCl + CH_3CH_2CH_2CH_2C(=O)CH_2CH_2CH_3 \longrightarrow$$

$$CH_3CH_2CH_2CH_2-C(CH_3CH_2)(CH_2CH_2CH_3)-OMgCl \xrightarrow{H^+OH^-} CH_3CH_2CH_2CH_2-C(CH_3CH_2)(CH_2CH_2CH_3)-OH + Mg(OH)Cl$$

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

Answer

Starch are major groups of natural compounds that yield ethanol by fermentation. The biological catalysts break down the carbohydral molecules into ethanol to give 95% yield.

*Starch containing materials like cereals are warmed with malt to 60°C for a specific period of time. It is then converted to maltose by the enzyme diastase containing malt

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{60^\circ C / \text{diastase}} nC_{12}H_{22}O_{11}$$

starch water maltose

* The maltose is then broken down to glucose by adding yeast which contains enzyme maltase. It is done at a temperature of 15°C

$$C_{12}H_{22}O_4 + H_2O \xrightarrow{15^\circ C / \text{maltase}} 2C_6H_{12}O_6$$

Maltose water glucose

* Glucose is then converted to alcohol at constant temperature of 15°C by an enzyme zymase which is found in yeast

$$C_6H_{12}O_6 \xrightarrow{15^\circ C / \text{zymase}} 2CH_3CH_2OH + 2CO_2$$

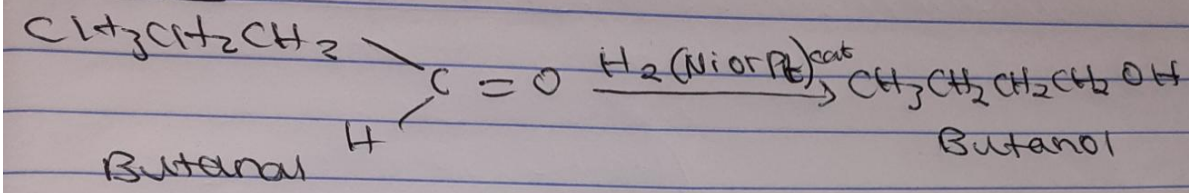
Ethanol carbondioxide

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

Answer

Using Meerwein - Ponndorf reaction

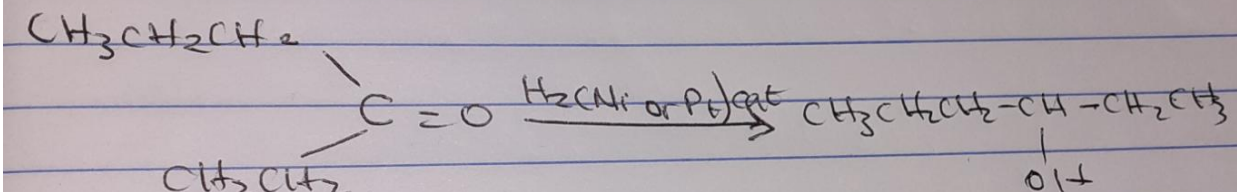
Alkanal



Butanal

Butanol

Alkanone



Hexan-3-one

Hexan-3-ol