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Department: MBBS
Matric number: 19/MHS01/230
Course: CHM 102

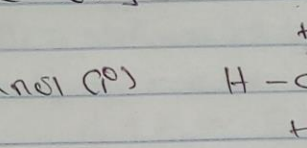
1. Discuss the two major classification of alkanols. give two examples each for each class.

A. ~~classification based on the number of hydrogen atoms attached to the carbon atom carrying the hydroxyl group:~~

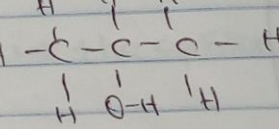
If the number of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two it is called Primary alkanol (1^0) [In a primary alkanol, the hydroxyl group is attached to a primary or terminal carbon atom in the molecule, it is characterized by $-CH_2OH$] If it is one hydrogen atom attached to the carbon atom bearing the hydroxyl group it is called "secondary alkanol (2^0)" [In a secondary alkanol, the $-OH$ group is on a secondary carbon atom. It is characterized by $>[HCOH]$ and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a "tertiary alkanol (3^0)" [In a tertiary alkanol, the $-OH$ is on a tertiary carbon. It is characterized by $>C-OH$]

Examples:

i) CH_3CH_2OH - Ethanol (1^0)



ii) $CH_3CH(OH)CH_3$ - Propan-2-ol (2^0)



3) Classification based on the number of hydroxy groups they possess:
Monohydric alkanols have only one hydroxyl group per molecules 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 groups present in the structure of the alkanol. Polyhydric alkanols or Polyols have more than three hydroxyl groups.

Examples

i) $CH_3CH_2CH_2OH$ → Propan-1-ol [Monohydric alkanols]

ii) $CH_3CH(OH)CH_2CH(OH)CH_2CH_3$ → Hexane-2,4-diol [Dihydric alkanol]

2] In the Grignard Synthesis of alkanols, react a named grignard reagent with $CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3$ show the reaction steps

Answers

Grignard reagent: CH_3CH_2MgCl [ethyl magnesium chloride]

$$CH_3CH_2MgCl + CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3 \longrightarrow$$

$$CH_3CH_2CH_2-\underset{\displaystyle CH_2CH_2CH_3}{\overset{\displaystyle CH_3CH_2}{\overset{|}{C}}}-OMgCl \xrightarrow{H^+Cl^-\ \text{dil. acid}} CH_3CH_2CH_2CH_2-\underset{\displaystyle CH_2CH_2CH_3}{\overset{\displaystyle CH_3CH_2}{\overset{|}{C}}}-OH + Mg(OH)Br$$

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

Answer

Industrial Preparation 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 catalyst, enzymes found in yeast break down the carbohydrate molecules into 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°C for a specific period of time are converted into maltose by the enzyme diastase

contained withe malt

$2[C_6H_{10}O_5)_n + nH_2O \xrightarrow[\text{diastase}]{60^oC} nC_{12}H_{22}O_{11}$

Carbohydrate — maltose

Step 2: the maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 15°c

$C_{12}H_{12}O_{11} + H_2O \xrightarrow[\text{maltase}]{15^oC} 2C_6H_{12}O_6$

Maltose — glucose

Step 3: The glucose at constant temperature of 15°c is then converted into alcohol by the enzyme zymase contained also in yeast.

$C_6H_{12}O_6 \xrightarrow[\text{zymase}]{15^oC} 2CH_3CH_2OH + 2CO_2\uparrow$

Glucose. — Ethanol — Carbon (IV) oxide

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

The reduction of alkanone and alkanal using MEERWEIN – PONNDORF REACTION

ALKANAL

$CH_3CH_2CH_2-C(=O)-H \xrightarrow[\text{OR } LiAlH_4]{H_2[Ni, or Pt]cat} CH_3CH_2CH_2CH_2OH$

Butanal — Butanol

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

ALKANONE

$CH_3CH_2CH_2-C(=O)-CH_2CH_3 \xrightarrow[\text{OR } LiAlH_4]{H_2[Ni, or Pt]cat} CH_3CH_2CH_2-CH(OH)-CH_2CH_3$

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]