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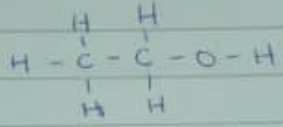
MATRIC NO: 19/MHS01/370
COURSE: CHEM 102

1. Discuss the major classification of Alkanols with two examples each

A Based on the number of hydrogen atoms attached to the carbon carrying the hydroxyl group

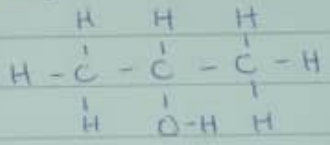
- Primary - The carbon carrying the hydroxyl group has two or three hydrogen atoms attached.

Eg Ethanol:



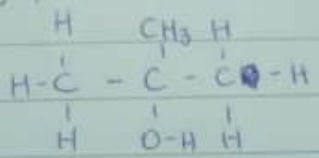
- Secondary alkanols: The carbon carrying the hydroxyl group has only one hydrogen atom attached.

Eg Propan-2-ol:



- Tertiary alkanols: The carbon carrying the hydroxyl group has no hydrogen atom attached to it.

Eg 2-methylpropan-2-ol



B Classification based on the number of hydroxyl groups they posses

- Monohydric alkanols: have only one hydroxyl group attached per alkanol structure Eg propanol, ethanol

- Dihydric alkanols: have two hydroxyl groups per alkanol structure Eg Hexan-2,4-diol $CH_3CH(OH)CH_3CH(OH)CH_2CH_3$

- Trihydric alkanols: have three hydroxyl groups per alkanol structure Eg 1,2,3-Propantriol

- Polyhydric alkanols: have more than three hydroxyl groups per alkanol structure.

2 Discuss the solubility of alcohol in water and in organic solvents

- In water: Alcohol is soluble in water due to the presence of the hydroxyl group which can form hydrogen bonds with water. Alcohols with smaller hydrocarbon chains are more soluble than those with higher hydrocarbon chains All monohydric alkanols are soluble in organic solvent

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

- Carbohydrates can be made to yield ethanol by the biological process of fermentation.

Step 1: The starch containing substance is warmed with malt to 60°C for a specific period of time to convert it to maltose by the enzyme diastase contained in the malt.

$$2(C_6H_{10}O_5)n + nH_2O \xrightarrow[60°C]{\text{diastase}} nC_{12}H_{22}O_{11}$$

carbohydrate. maltose

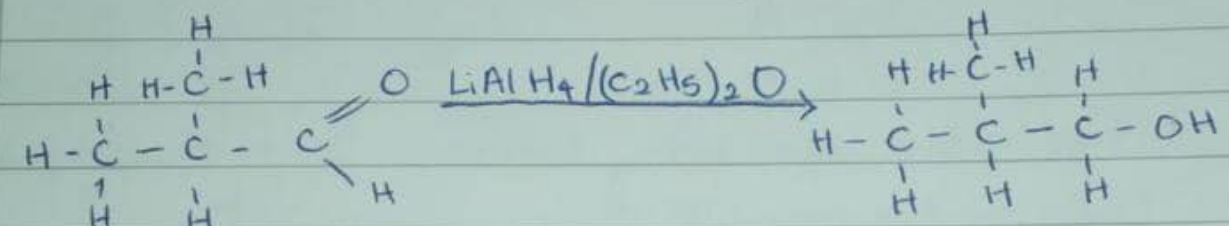
Step 2: The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at the temperature of 15°C

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{maltase}]{15°} 2C_6H_{12}O_6$$

Step 3: The glucose at 15°C is the converted to alcohol by the enzyme zymase contained in yeast.

$$C_6H_{12}O_6 \xrightarrow[\text{zymase}]{15°C} 2CH_3CH_2OH + 2CO_3$$

7 Show the reduction reaction of 2-methylpropanal

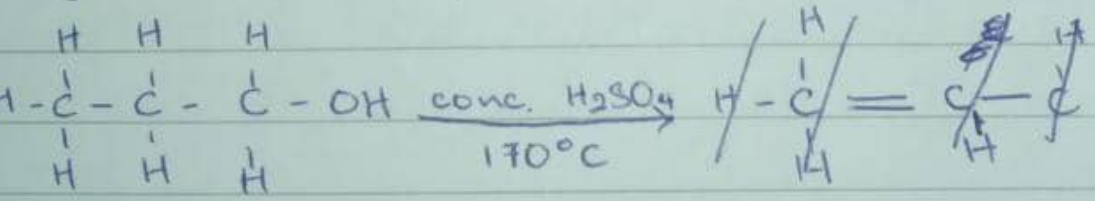


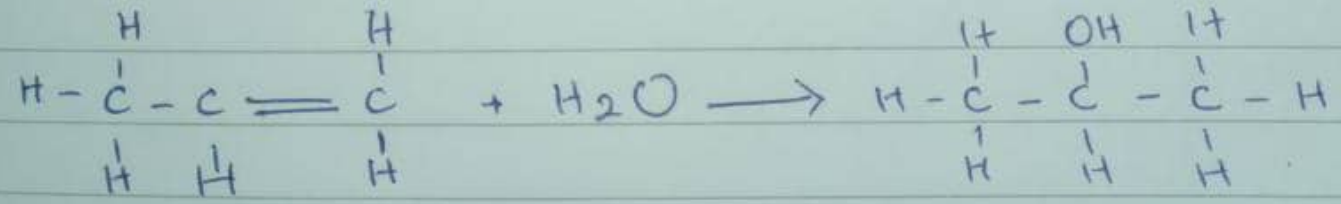
2-methylpropanal

2-methylpropan-1-ol

8 Propose a scheme for the conversion of propan-1-ol to Propan-2-ol.

- Heat propan-1-ol in the presence of sulphuric acid to dehydrate it to propene. Then add water to form propan-2-ol





propan-2-ol

4 Show the reaction between 2-methylpropanal and butylmagnesiumchloride.

Grignard reagent: C_4H_9MgCl

$$C_4H_9MgCl + (CH_3)_2CHCHO \rightarrow (CH_3)_2CH-\underset{\underset{H}{|}}{\overset{\overset{C_4H_9}{|}}{C}}-OMgCl$$

$$(CH_3)_2CH-\underset{\underset{H}{|}}{\overset{\overset{C_4H_9}{|}}{C}}-OMgCl \xrightarrow[\text{dil acid}]{H^+\ OH^-}$$

$$(CH_3)_2CH-\underset{\underset{H}{|}}{\overset{\overset{C_4H_9}{|}}{C}}-OH + Mg(OH)Cl$$