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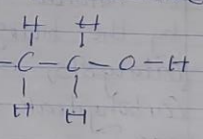
Course: Chem 102
College: MHS

ASSIGNMENT

1) Classification of Alcohols are:

a) Classification based on the number of hydrogen atoms attacked to the carbon atom containing 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 a "Primary alcohol (1°)" (In a primary alcohol, 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 carbon atom bearing the hydroxyl group it is called "Secondary alcohol (2°)". (In a second alcohol, the $-OH$ group is on a secondary carbon atom, it is characterized by $>CHOH$) and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a "tertiary alcohol (3°) (In a tertiary alcohol, the $-OH$ group is on a tertiary alcohol (3°)" (In a tertiary alcohol, the $-OH$ group is on a tertiary carbon. It is characterized by $>C-OH$)

Example: Ethanol (1°) $-CH_3CH_2OH$:



b) Classification based on the number of hydroxyl groups they possess: monohydric alcohols have only one hydroxyl group per molecule present in the alcohol structure. Dihydric alcohols also called Glycols have two hydroxyl groups present in the alcohol structure. While trihydric alcohols or triols have three hydroxyl groups present in the structure of the alcohol. Polyhydric alcohols or

polyols have more than three hydroxyl groups.
Example: $CH_3CH_2CH_2OH$ - Propanol (monohydric alcohol).

2) Solubility of Alcohols in water, Organic solvents are:

→ Solubility in water: lower alcohols with up to three carbon atoms in their molecules are soluble in water because these lower alcohols can form hydrogen bond with water molecules. The water solubility of alcohols decreases with increasing relative molecular mass.

→ Solubility in Organic solvents: All monohydric alcohols are soluble in organic solvents. The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules.

3) Steps in the industrial manufacture of ethanol with equations of reaction.

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 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 in the malt

$$\underset{\text{Carbohydrate}}{2(C_6H_{10}O_5)_n} + \underset{\text{water}}{nH_2O} \xrightarrow[\text{diastase}]{60^\circ C} \underset{\text{maltose}}{nC_{12}H_{22}O_{11}}$$

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

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{maltase}]{15^\circ c} 2C_6H_{12}O_6$$
maltose, water, glucose.

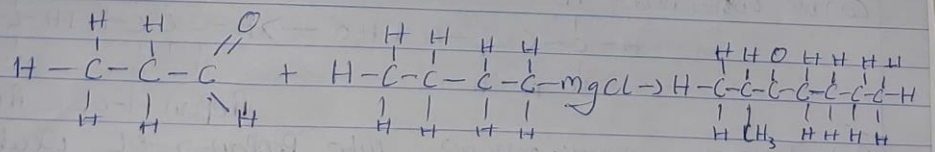
Step 3: The glucose at constant temperature of 15°c is then converted into alcohol by the enzyme zymase contained also in yeast.

$$C_6H_{12}O_6 \xrightarrow[\text{zymase}]{15^\circ c} 2CH_3CH_2OH + 2CO_2\uparrow$$
Glucose, ethanol, Carbon(IV)oxide

4) Reaction between 2-methylpropanal and butylmagnesiumchloride. Hint: Grignard synthesis

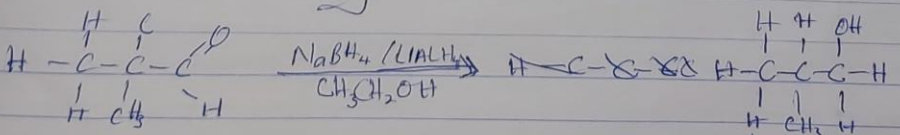
2-methyl propanal + Butylmagnesium Chloride ⟶ ?

$CH_3CHCH_3CHO + CH_3CH_2CH_2CH_2-MgCl \rightarrow CH_3(HCH_3C(OH)CH_2CH_2CH_2CH_3$

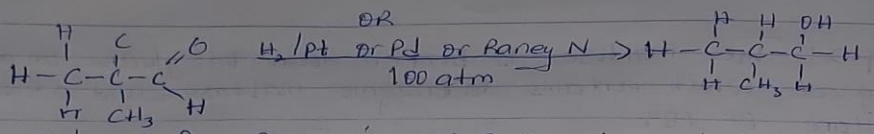


2-methyl 3-heptanol

Reaction of 2-methylPropanal

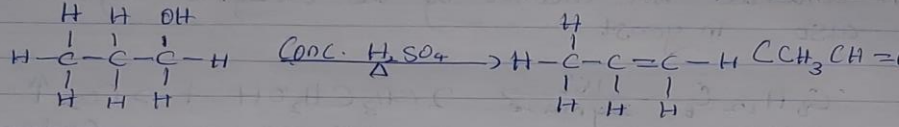


2-methylpropanol.

ii) 

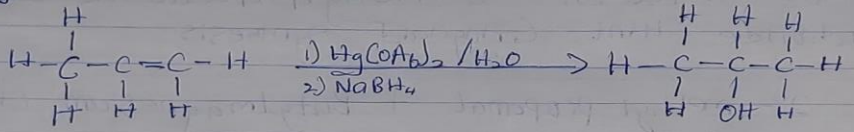
8) A Scheme for Conversion of Propan-1-ol to Propan-2-ol

Step 1: Dehydration of Propan-1-ol to Propene using Conc. H_2SO_4

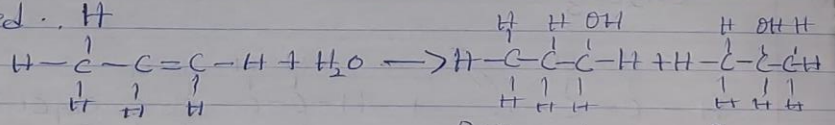


Step 2: you can use either

A) Oxymercuration – Demercuration.



B) Since Propene is assymetrical, on hydrolysis or addition of water using a markovnikoo procedure. Propan-2-ol can be obtained.



Propan-1-ol Propan-2-ol

But following markovnikoo's rule, Propan-2-ol would be the major product.