Name: OGBOGU CHIDUBEM CHRISTIAN
Mat. No.: 19/MHS11/100
Dept.: PHARMACY
Course: CHM102

ASSIGNMENT

1. Alcohols are very important organic compounds. Discuss briefly their classification and give one example each.

Answer

Classification of Alcohols are;

A. Classification based on the number of hydrogen atoms attached to the carbon atom containing the OH group;

i. If 2 or 3 hydrogen atoms are attached to the carbon atom bearing the OH group, it is called a primary alcohol (1°).
ii. If one hydrogen atom is attached, it is called a secondary alcohol (2°).
iii. If no hydrogen atom is attached to the carbon atom, it is a tertiary alcohol (3°).

Examples.

Methanol CH_3OH (1°)

Propan-2-ol $CH_3CH(OH)CH_3$ (2°)

B. Classification based on the number of hydroxyl groups they possess;

Monohydric alcohol have one OH group present in the alcohol structure. Dihydric alcohols are called glycols, they have 2 hydroxyl group present in the structure while Trihydric alcohols or triols have 3 OH groups present in the structure of the alcohol. Polyhydric alcohols or polyols have more than 3 OH groups.

Examples

Monohydric alcohol – Propanol $CH_3CH_2CH_2OH$

Dihydric alcohol – Ethane1, 2 diol $HOCH_2$-CH_2OH

2. Discuss the solubility of alcohols in water, organic solvents.

Answer:

Solubility of alcohols in water and organic solvents

Alcohols are soluble in water. This is due to the hydroxyl group in the alcohol which is able to form hydrogen bonds with water molecules. Alcohols with a smaller hydrocarbon chain are very soluble. As the length of the hydrocarbon chain increases, the solubility in water decreases. The reason why the solubility decreases as the length of hydrocarbon chain increases is because it is requires more energy to overcome the hydrogen bonds between the alcohol molecules as the molecules are more tightly packed together as the size and mass increases. Generally, non-polar solutes are soluble in non-polar solvents. Alcohol is soluble in organic solvents.

3. Show the three steps in the industrial manufacture of ethanol. Equations of reaction are mandatory.

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Answer:

Industrial manufacturer of Ethanol

Carbohydrate such as starch are major group 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%. On warming starch with malt to 60° for a specific perio6of time are converted into maltose by the enzyme diastase contained in the malt.

$2(C_6H_{10}O_5)n + nH_2O. \longrightarrow n(C_{12}H_{22}O_{11})$

Carbohydrate *60°C / diastase.* *Maltose*

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 15°.

$C_{12}H_{22}O_{11} + H_2O. \longrightarrow 2C_6H_{12}O_6$

Maltose. *15°C / maltase.* *Glucose*

The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme Zymase contained also in yeast

$C_6H_{12}O_6. \longrightarrow 2CH_3CH_2OH + 2CO_2$

Glucose. *15°C / Zymase* *Ethanol*

4. Show the reaction between 2-methylpropanal and butylmagnesiumchloride.

Answer:

$(CH_3)_2CHCH{=}O + C_4H_9MgCl \longrightarrow C_4H_9CH(CH_3)_2CH\text{-}OMgCl$

$\downarrow$ $+ H_2O$, Dilute acid

$C_4H_9CH(CH_3)_2CH\text{-}OH + MgClOH$

5. Show the reaction between 2-methyl propanone and butylmagnesiumchloride.

Answer:

$(CH_3)_2CH_2C{=}O + C_4H_9MgCl \longrightarrow C_4H_9(CH_3)_2C\text{-}OMgCl \xrightarrow{H_2O,\ dilute\ acid}$

$C_4H_9CH_2(CH_3)_2C\text{-}OH + MgClOH$

6. Show the reduction reaction of 2-methylpropanone.

Answer:

$(CH_3)_2CHCH{=}O \longrightarrow (CH_3)_2CHCH_2OH$

2methyl propanal

7. Show the reduction reaction of 2-methylpropanal

Answer:

$(CH_3)_2CH_2C{=}O \longrightarrow (CH_3)_2CH_2CH\text{-}OH$

2methylpropanone

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

Answer:

$CH_3\text{-}CH_2\text{-}CH_2\text{-}OH$ (propan-1-ol)
Heat in the presence of concentrated H_2SO_4 ,to dehydrate it and form propene $(CH_2{=}CH\text{-}CH_3)_2$

$CH_3\text{-}CH_2\text{-}CH_2\text{-}OH \longrightarrow CH_2{=}CH\text{-}CH_3$ (after heating with concentrated H_2SO4)

Now to propene add water (you may use mercuric acetate as it favours Markownikoff addition)

CH_3-CH=CH_2 + H_2O = CH_3-CH(OH)-CH_3 (propan-2-ol)