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**COURSE CODE: CHM 102**

**DEPARTMENT : MEDICINE AND SURGERY**

**MATRIC NO: 19/MHS01/366**

**ASSIGNMENT**

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

a)CLASSIFICATION BASED ON THE NUMBER OF HYDROGEN ATOM ATTACHED TO THE CARBON ATOM CARRYING THE HYDROXYL GROUP: It has three sub classifications. When two or three hydrogen atom are attached to the carbon atom carrying the hydroxyl group it is called **PRIMARY ALCOHOL (1°).** When one hydrogen atom is attached to the carbon atom carrying the hydroxyl group it is referred to as **SECONDARY ALCOHOL (2°).** When no hydrogen atom is attached to the carbon atom carrying the hydroxyl group it is called **TERTIARY ALCOHOL (3°).**

Examples include:

CH3OH (METHANOL) 1°(PRIMARY ALCOHOL)

CH3CH(OH)CH3 (PROPAN-2-OL) 2°(SECONDARY ALCOHOL)

(CH3)3C-OH (2-METHYL PROPAN-2-OL) 3°(TERTIARY ALCOHOL)

b) CLASSIFICATION BASED ON THE NUMBER OF HYDROXYL GROUP PRESENT IN THE ALCOHOL STRUCTURE: It has four sub classification. If one hydroxyl group is present, it is referred to as **MONOHYDRIC ALCOHOL.** If two hydroxyl groups are present, it is called **DIHYDRIC ALCOHOL** OR **GLYCOL.** If three hydroxyl groups are present it is called

**POLYHYDRIC ALCOHOL** OR **POLYOL.**

Examples are:

CH3CH2CH2 (PROPANOL) MONOHYDRIC ALCOHOL

HOCH2CH2OH (ETHANE-1,2-DIOL) GLYCOL/DIHYDRIC ALCOHOL

OHCH2CH(OH)CH2OH (PROPAN-1,2,3-TRIOL) TRIOL/TRIHYDRIC ALCOHOL )

CH3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH3 (HEPTAN-2,3,4,5,6-PENTAOL) POLYOL/POLYHYDRIC ALCOHOL

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

Alcohols with up to three carbon atoms in their molecules (lower alcohols) are soluble in water. This is because they can form hydrogen bond with water molecule. The solubility of alcohols in water decreases with increasing relative molecular mass. The solubility of simple alcohols and polyhydric alcohol is largely due to their ability to form hydrogen bond with water molecules.

As for organic solvents, monohydric alcohols are soluble in them.

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

The industrial preparation of ethanol is referred to as fermentation. Carbohydrates such as starch are major group of natural compounds that can be made to yield ethanol by the fermentation process. The enzymes found in yeast break down the carbohydrate molecules into ethanol. Some starch containing material include: potatoes, rice etc. On warming any of these with malt at a temperature of 60°C for a specific period of time converts it to Maltose by the enzyme diastase present in malt.

2(C6H10O5)n +nH2O >>> nC12H22O11

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

C12H22O11 + H2O >>>>>>> 2C6H12O6

Maltose 15°C/maltase glucose

The glucose at constant temperature of 15°C is then converted into alcohol(ethanol) by the enzyme zymase also found in yeast.

C6H12O6 >>>>>>>>> 2CH3CH2OH + 2CO2

Glucose 15°C/Zymase Ethanol

1. Show the reaction between 2-methylpropanal and butylmagnesiumchloride  Hint: Grignard synthesis

2-METHYLPROPANAL: l

GRIGNARD REAGENT:CH3CH2CH2CH2MgCl(Butyl Magnesium Chloride)

(C2H5)2O

CH3CH(CH3)C=OH+ CH3CH2CH2CH2MgCl 🡺 H

|

CH3CH(CH3) —C—OMgCl

|

CH2CH2CH2CH3

H+/OH-

🡺 H

|

CH3CH(CH3) —C—OH + MgCl(OH)

|

CH2CH2CH2CH3

(2-METHYL HEPT-3-OL) (HYDROXY MAGNESIUM CHLORIDE)

7.Show the reduction reaction of 2-methylpropanal

CH3CH(CH3)C=OH >>>>>>>>>>> CH3CH(CH3)CH2OH

2-METHYL PROPANAL LiAlH4/(C2H5)2O 2-METHYL PROPANOL

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

PROPAN-1-OL : CH3CH2CH2OH

It is a two step process:

STEP ONE : dehydrate the propan -1-ol

1. Heat propanol with a dehydrating agent (conc. H2SO4)

CH3CH2CH2OH+H2SO4 🡺 CH3CH2CH2OH2HS04 CH3CH2CH2OH2HS04 🡺 CH3CH2CH2HSO4

CH3CH2CH2HSO4 🡺 CH3CH=CH2 + H2SO4

PROPENE

STEP TWO: HYDRATION OF PROPENE

The propene obtained is oxidized in the presence of water (H2O) with a mild oxidizing agent(17% alkaline KMNO4) at low temperature. This step follows markonikoff’s rule.

KMNO4

CH3CH=CH2 + H2O + [O] 🡺 CH3CHOHCH3

H+/OH-