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Course:-Chem 102 (new assignment)

(1) a) this is based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group.If the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two it is called a primary alcohol (1º) if it’s one it’s called a secondary alcohol (2º) and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it’s called a tertiary alcohol (3º).Examples include:-

CH3OH(methanol(1º) ),CH3CH(OH)CH3(propan-2-ol(2º) ),(CH3)3C-OH (2-Methylpropan-2-ol (3º).

b) This is based on the number of hydroxyl groups they possess; monohydric alcohols have one hydroxyl group present in the alcohol structure. Dihydric alcohols are also called glycols which have two hydroxyl groups present in the alcohol structure while dihydric alcohols or triols have three hydroxyl groups present in the structure of the alcohol.

Polyhydric alcohols or polyols have more than three hydroxyl groups.

Examples are:-

CH3CH2CH2OH (propanol (monohydric alcohol))

HOCH2CH2OH(ethane-1, 2-diol (dihydric alcohol))

OHCH2CH(OH)CH2OH(propane-1,2,3-triol(trihydric alcohol))

CH3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH3 (Heptane-2,3,4,5,6-pentaol(polyhydric alcohol)).

(2) 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.

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)

Industrial manufacture of ethanol:-

Carbohydrates 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%.The starch containing materials include molasses,potatoes,cereals,rice and on warming with malt to 60ºc for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.

2(C6H10O5)n + nH2O nC12H22O11

Carbohydrate 60ºC/diastase Maltose

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

C12H22O11 +H2O 2C6H12O6

Maltose 15ºc/maltase glucose

The glucose at constant temperature of 15ºc is then converted into alcohol by the enzyme zymase contained also in yeast

C6H12O6 2CH3CH2OH + 2CO2

Glucose 15ºc/zymase Ethanol

(4) reaction between 2-methylpropanal and butylmagnesiumchloride :-

H+ OH+

R’RC=O +RMgX RR’R’’C-OMGX dil acid RR’R’’C-OH + Mg(OH)X

(7)  Reduction reaction of 2-methylpropanal:-

(i) RCHO RCH2OH

Aldehyde LiALH4/(C2H5)2O  Primary alcohol

(ii) RR’C=O RR’CHOH

Ketone LiAlH4/(C2H5)2O Secondary alcohol

(8)  a scheme for the conversion of propan-1-ol to propan-2-ol:-

(i)

CH3CH2CH2OSO3H CH3CH=CH2 + H2SO4

(ii)

CH3CH=CH2 + H2O CH3 CH CH3

OH