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MEDICINE AND SURGERY

CHEM 102

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

Basically alcohols are classified in two major ways;

1. They are classified based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. This classification is further divided into three; when there are two or three hydrogen atoms attached to the carbon atom bearing the hydroxyl group it is referred to as primary alcohol (1°), when there is one hydrogen atom it is known as secondary alcohol (2°) and when there is no atom of hydrogen attached to the carbon atom bearing the hydroxyl group it is a tertiary alcohol (3°). Example; CH3CH(OH)CH3-Propan-2-ol
2. They are also classified based on the number of hydroxyl groups they possess. They may also be further divided into three; Monohydric alcohols have one hydroxyl group, Dihydric alcohols (Glycols) have two hydroxyl groups present in their structure and Trihydric alcohols (Triols) have three hydroxyl groups present in their structures. Example; CH3CH2CH2OH-Propanol
3. Discuss the solubility of alcohols in water, organic solvents.

The lower alcohols with up to three carbon atoms are soluble in water because these lower alcohols possess the ability to form hydrogen bonds with water molecules. The solubility of alcohols in water decreases with increasing relative atomic mass. The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules. All monohydric alcohols are soluble in organic compounds.

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

Ethanol is produced industrially by the process of fermentation. The steps are as follows;

Step 1: A carbohydrate (polysaccharide) undergoes warming with malt at 60°C for a specific period of time and is converted into maltose by the enzyme diastase contained in the malt.

2(C6H10O5) n + n H2O ---------------------- n C12H22O11

60°C/diastase maltose

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

C12H22O11 + H2O -------------------- 2 C6H12O6

Maltose 15°C/maltase glucose

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

C6H12O6-------------- 2CH3CH2OH + 2CO2

Glucose 15°C/Zymase ethanol

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

The reaction above is Grignard synthesis;

Methylpropanal; CH3CH2CH2CHO

Butylmagnesiumchloride; CH3CH2CH2CH2MgCl

CH3 CH3

CH3CH2 CH2 CH2MgCl + CH3 CH2-C=O ----------- CH3CH2-C-OMgCl

CH3CH2CH2 CH2

H+OH-

CH3

CH3CH2-C-OH + Mg(OH)Cl

CH3CH2CH2CH2

1. Show the reduction of 2-methylpropanal

When 2-methylpropanal is reduced a primary alcohol is obtained.

2-methylpropanal; (CH3)2CHCHO

The reducing agent used is NaBH4(Sodiiumtetrahydridoborate(iii)).

CH3 H NaBH4

H3C-CH-C-=O ---------------- CH3CH2CH2CH2

H3O+ 2-methylpropanol

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

First dehydrate propanol;

CH3CH2CH2OH + H2SO4 ------------- CH3CH2CH2OH2OSO3H

-H2O

CH3CH2CH2OSO3H (Propylhydrogensulfate)

Hydrolysis

-H2SO4

CH3CH=CH2 (Propene)

+H2O

CH3CHCH3

OH

The final stage shows propan-2-ol.