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Assignment

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

Soln

ⓐ They are classified based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group
- If it is more than two hydrogen atoms ⟹ 1° (primary alcohol)
- If it is more just one hydrogen atom ⟹ 2° (Secondary alcohol)
- If it is none ⟹ 3° (Teotiary alcohol)

Example; CH_3OH (1° ⟹ primary alcohol)

ⓑ They are also classified based on the number of hydroxyl group they possess.

Soln
- Monohydric alcohol ⟹ If there is only one hydroxyl group
- Dihydric alcohol ⟹ If there are two hydroxyl groups
- Trihydric alcohol ⟹ If there are three hydroxyl group
- Polyhydric alcohol ⟹ If there are more than three hydroxyl groups

Example; $HOCH_2CH_2OH$ (Ethane-1,2-diol) (Dihydric alcohol)

② Discuss the solubility of alcohols in water, organic solvents

Soln

For water :-

All lower alcohols with up to three carbon atoms in their molecules are soluble because they can form hydrogen bonds with water molecules.

For Organic solvent :-

All monohydric alcohols are soluble in organic solvents.

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

Soln

$$2(C_6H_{12}O_5)_n + nH_2O \xrightarrow{60°C/\text{diastase}} nC_{12}H_{22}O_{11}$$

Carbohydrate → Maltose

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

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{15°C/\text{maltose}} 2C_6H_{12}O_6$$

Maltose → Glucose

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

$$C_6H_{12}O_6 \xrightarrow{15°C/\text{zymase}} 2CH_3CH_2OH + 2CO_2$$

Glucose → Ethanol

④ Show the reaction between 2-methylpropanal and butylmagnesiumchloride
Hint :- Grignard synthesis

Soln

$$CH_3CH_2CH_2CH_2MgCl + \underset{CH_3}{\overset{CH_3}{|}}-CHCHO$$

$$\underset{H}{\overset{(CH_2)_3CH_3)_2CH}{|}}-CH_3 + OMgCl \xrightarrow[H^+, OH]{NH_4Cl} \underset{H}{\overset{(CH_2)_3CH_3)_2}{|}}-CH_3-OH + Mg(OH)Cl$$

⑦ Show the reduction reaction of 2-methylpropanal

Soln

$$(CH_3)_2CHCHO \xrightarrow{LiAlH_4/H_2O} CH_3CH_2CH_2CH_2(OH)$$

(2-methylpropanal) → butanol (1° alcohol)

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

Soln

Propan-1-ol: $CH_3CH_2CH_2OH$ → Propan-2-ol: $CH_3CH_2OHCH_3$

$$CH_3CH_2CH_2OH + H_2SO_4 \longrightarrow CH_3CH_2CH_2OH_2OSO_3H$$
$$CH_3CH_2CH_2OH_2OSO_3H \xrightarrow{-H_2O} CH_3CH_2CH_2OSO_3H$$
$$CH_3CH_2CH_2OSO_3H \xrightarrow{-H_2SO_4} CH_3CH=CH_2$$
$$CH_3CH=CH_2 \xrightarrow{H^+\ OH^-} CH_3CH_2(OH)CH_3$$

(Propan-2-ol)

NOTE :-
Nos 5 & 6 have no answer because there is no compound like 2-methylpropanone