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CHEM 102

Assignment.

1) Discuss the two major classification of Alkanols. Give two examples each for each class

⇒ Based on the number of hydrogen atoms attached to the Carbon atom that is carrying the hydroxyl (-OH) group

(a) Primary alcohol (1°) ⇒ If the number of hydrogen attached to the Carbon carrying the (OH) group are two or three
E.g CH_3OH (Methanol), $CH_3CH_2CH_2OH$ (Propanol)

(b) Secondary alcohol (2°) - This is obtained if the hydrogen atom attached to the Carbon atom carrying the -OH- is one
e.g $CH_3CH(OH)CH_3$ - Propan-2-ol, $CH_3(CHOH)CH_2CH_3$ - 2 hydroxyl

(c) Tertiary alcohol (3°) - This is formed when there is no hydrogen atom attached to the Carbon atom carrying the hydroxyl group. e.g $(CH_3)_3-C-OH$ - 2-methyl propa-2-ol
$C_5H_{12}-C(CH_3)(OH)-CH_3$ - 3 methyl butan-2-ol

⇒ Based on the number of hydroxyl group they possess

(a) Monohydric alcohol: Presence of one hydroxyl group eg CH_3OH
CH_3CH_2OH

(b) Dihydric alcohol: Have two hydroxyl groups eg $OHCH_2CH_2OH$,
$CH_3CH(OH)CH(OH)CH_3$

(c) Trihydric alcohol: Presence of three hydroxyl group
E.g Propane $OHCH_2CH(OH)CH_2OH$ → Propene-1, 2, 3, triol

(d) Polyhydric alcohol: Have more than three hydroxyl group
e.g $CH_2(CH(OH))_5CH_3$ ⇒ Heptane-2,3,4,5,6-
Pentaol (Polyhydric alcohol), $CH_3(CH(OH))_6CH_3$ ⇒ Octan-2,3,4,5,6,7-hexanol

2) In Grignard synthesis of Alkanols react a named reagent with $CH_3CH_2CH_2CH_2C(=O)CH_2CH_2CH_3$. Show the steps

Grignard reagent - CH_3MgCl

$CH_3CH_2CH_2CH_2C = CCH_2CH_2CH_3 + CH_3MgCl \rightarrow CH_3CH_2CH_2CH_2-C(CH_3)(CH_2CH_2CH_3)-O-MgCl$

Octan-4-ene — Grignard reagent

$CH_3CH_2CH_2CH_2-C(CH_3)(CH_2CH_2CH_3)-O-MgCl \xrightarrow[dil.\ acid]{H^+\ OH^-} CH_3CH_2CH_2CH_2-C(CH_3)(CH_2CH_2CH_3)-OH + Mg(OH)Cl$

3.) Discuss the Industrial Manufacture of ethanol showing all reaction and necessary enzymes and temperature of reaction

$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow[60°C]{diastase} C_{12}H_{22}O_{11}$

Starch — Maltose

$C_{12}H_{22}O_{11} + H_2O \xrightarrow[15°C]{maltase} 2C_6H_{12}O_6$

Maltose — Glucose

$C_6H_{12}O_{6(aq)} \xrightarrow[15°C]{zymase} 2C_2H_5OH_{(aq)} + 2CO_{2(g)}$

Glucose — Ethanol

4.) Determine the Product obtained in the reduction of Alkanone and Alkanal. Use a Specific example for each and show the eqn of reaction.

Alkanal $R-C(H)=O + H_2 \xrightarrow{Ni} R-C(H)(H)-OH$

Example $CH_3CH=OH + H_2 \xrightarrow{Ni} CH_3-C(H)(H)-OH$ ⇒ Primary alkanol

Ethanal — Ethanol

Alkanol $R-C(R')=O + H_2 \xrightarrow{Pt} H-C(R)(R')-OH$

Example

$CH_3-C(CH_3)=O + H_2 \xrightarrow{Pt} H-C(CH_3)(CH_3)-OH$ Propan-2-ol

Propanal.