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19/MHS01/187

1) Two major classification of Alkanols, with two examples each

ANSWER

Primary Alkanols: are those alkanol that the hydroxyl group is attached to a primary (terminal) carbon atom in the molecule. It is characterized by $-CH_2OH$.

Examples
i) CH_3OH Methanol
ii) CH_3CH_2OH Ethanol
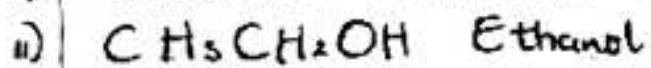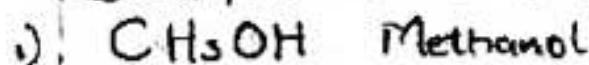
Secondary Alkanols: In secondary alkanol, the OH group is on a secondary carbon atom characterized by $>CHOH$

Examples
i) $CH_3CH(OH)CH_3$ Propan-2-ol
ii) $(CH_3)C-OH$ 2-methylpropan-2-ol
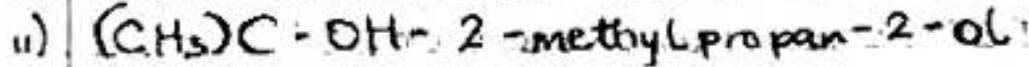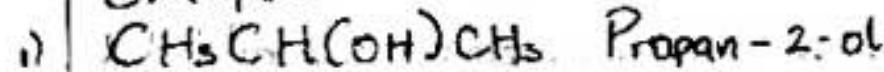
2) In the Grignard Synthesis of Alkanols, react a named Grignard reagent with

$CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3$. Show the reaction steps.

First Stage

~~$CH_3CH_2MgBr + CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3 + CH_3CH_2C$~~

$$CH_3CH_2MgBr + CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3 \rightarrow CH_3CH_2-\overset{\overset{\displaystyle CH_3CH_2CH_2CH_2}{|}}{\underset{\underset{\displaystyle CH_2CH_2CH_3}{|}}{C}}-OMgBr$$

Dilute acid is then added to this to hydrolyze it

$$CH_3CH_2-\overset{\overset{\displaystyle CH_3CH_2CH_2CH_2}{|}}{\underset{\underset{\displaystyle CH_2CH_2CH_3}{|}}{C}}-C-MgBr + H_2O \xrightarrow{H_3O^+} CH_3CH_2-\overset{\overset{\displaystyle CH_3CH_2CH_2CH_2}{|}}{\underset{\underset{\displaystyle CH_2CH_2CH_3}{|}}{C}}-CH + Mg(OH)Br$$
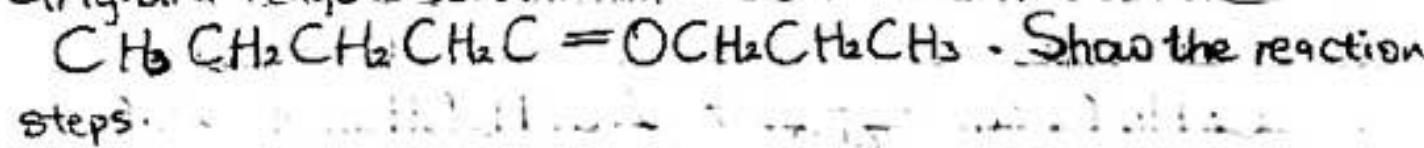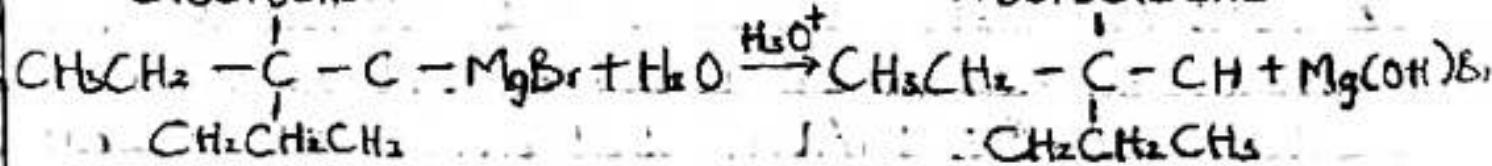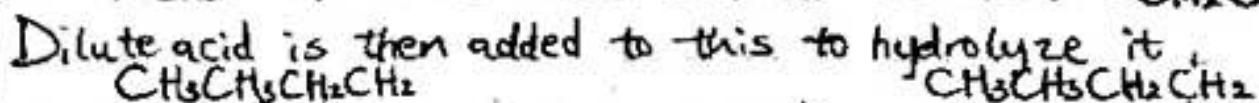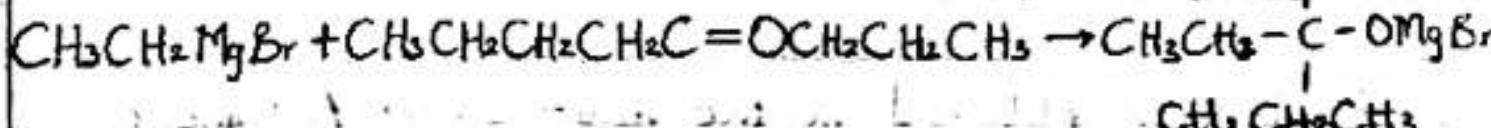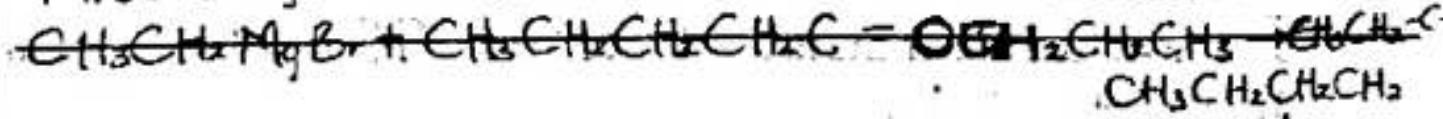
An alcohol is formed - The key of Grignard reagent is the ability to make complicated alcohols easily.

3) Industrial preparation of Ethanol

a) The starch containing crop such as cassava, is peeled, crushed and steam-heated or pressure cooked to release water, to obtain a marsh.

b) The marsh is treated with malt, yeast and warmed at 50°c for two (2) hours. Enzyme diastase in the malt hydrolyses starch for maltose.

$$2 (C_6 H_{10} O_5)_n \text{ (aq)} + n H_2 O \xrightarrow{\text{Diastase}} n (C_{12} H_{22} O_{11}) \text{ (aq)}$$
$$\text{(starch)} \qquad\qquad\qquad\qquad \text{(maltose)}$$
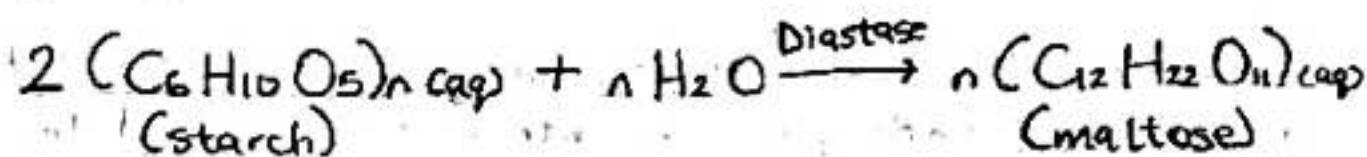
c) Yeast containing enzymes maltase and zymase is added to the mixture and kept at room temperature (about 20°c) for about three days. During this period, enzyme zymase ferments glucose to ethanol with the evolution of carbon (II) oxide. The reaction is exothermic.

$$C_{12} H_{22} O_{11} \text{ (aq)} + H_2 O \xrightarrow{\text{Maltase}} 2 C_6 H_{12} O_6 \text{ (aq)}$$
$$\text{(Maltose)} \qquad\qquad\qquad \text{(Glucose)}$$

$$C_6 H_{12} O_6 \text{ (aq)} \xrightarrow{\text{zymase}} 2 C_2 H_5 OH \text{ (aq)} + 2 CO_2$$
$$\text{(Glucose)} \qquad\qquad \text{(Ethanol)}$$
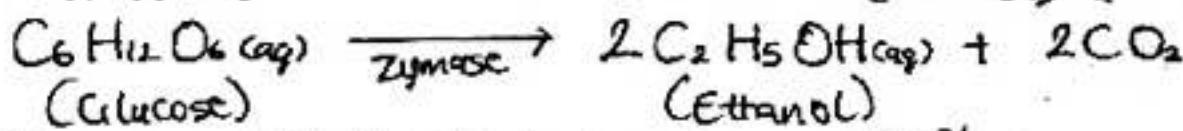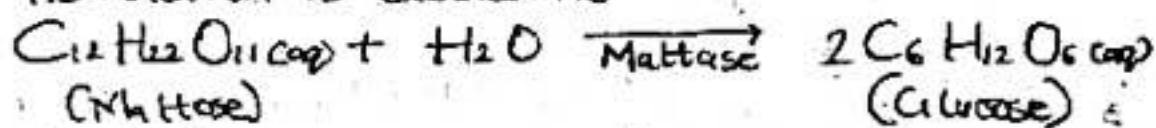
The mixture is distilled, to obtain 95% ethanol that boils at 78°c.

4 Production obtained in the reduction of Alkanone and Alkanal
ANSWER: Alkanals are reduced to the corresponding primary alkanols by reducing agents such as Lithium tetrahydro-calcuminated (IV) $LiAlH_4$ that provides the nascent hydrogen, [H], which causes reduction.

2) Ethanal is reduced to ethanol
$$CH_3 - C - H + 2[H] \xrightarrow{\Delta} CH_3 - CH_2$$
$$\text{[Ethanal]} \qquad\qquad\qquad \text{(Ethanol)}$$

b | Generally

$$R - CHO + 2[H] \longrightarrow R - CH_2 - O - H$$

(Alkanal)   (1 Alkanol)
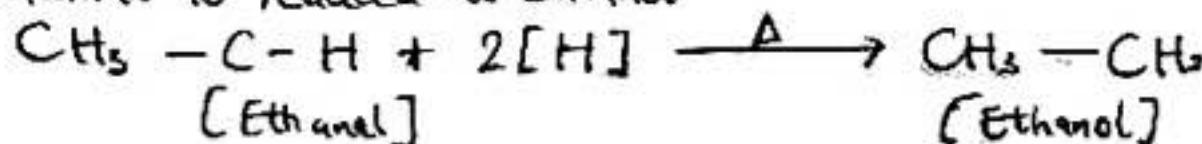
This reaction shows that alkanols are oxidizing agent.

Alkanones are reduced to the corresponding secondary alkanol. $LiAlH_4$ reduced propanone $CH_3 - CO - CH_3 + 2[H] - CH$ $- COH) - CH_3 +$ propan-2-ol. The reducing agent provides