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19/ENG02/006

Computer Engineering

~~Practice~~ Chemistry assignment

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

a) The first classification is based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. If the number of hydrogen atoms attached to the carbon containing the hydroxyl group are three or two, it is a primary ~~alcohol~~ <1°> alkanol. If it is one hydrogen atom, it is called secondary ~~alcohol~~ alkanol <2°>, and if no hydrogen atom is attached to the carbon containing the hydroxyl group, it is called a tertiary ~~alcohol~~ alkanol.

Examples of primary, secondary and tertiary alkanol are:
CH_3OH <methanol>, $CH_3CH(OH)CH_3$ <propan-2-ol> and $(CH_3)_3C-OH$ <2 methylpropan-2-ol> respectively.

b) The second classification is based on the number of hydroxyl groups they possess. If it has 1, 2, 3, or more than 3 are called monohydric, dihydric <glycols>, trihydric <triols> and polyhydric alkanols.

Examples: $CH_3CH_2CH_2OH$ <propanol> – Monohydric alkanol

$HOCH_2CH_2OH$ <ethan-1,2-diol> – Dihydric alkanol

$OHCH_2CH(OH)CH_2OH$ <propane-1.2.3-triol> – Trihydric alkanol

$CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$ <Heptane-2,3,4,5,6-Pentanol> – Polyhydric

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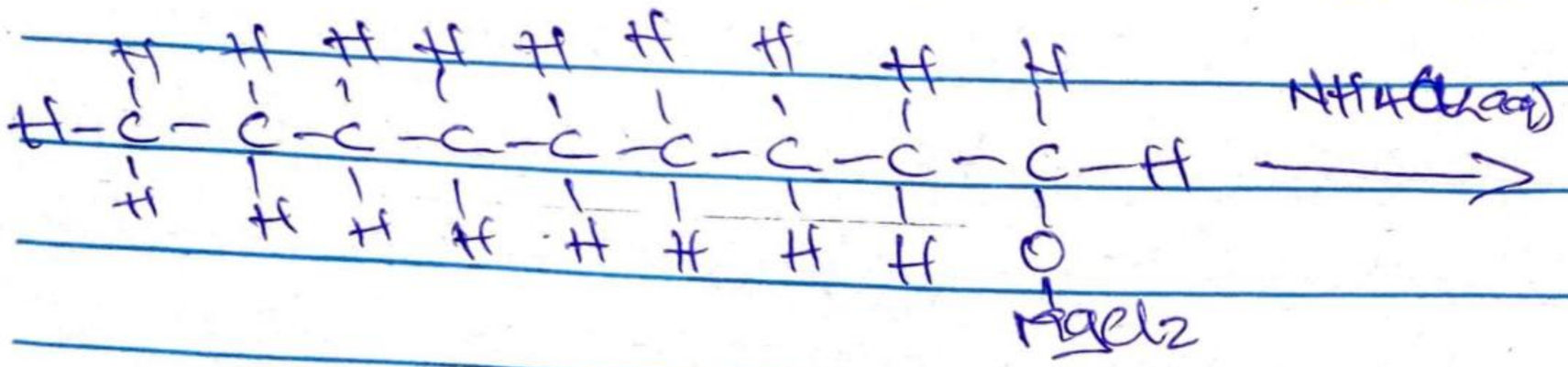
2) In the grignard synthesis of Alkanols, react a named Grignard reagent with $CH_3CH_2CH_2CH_2C{=}OCH_2CH_2CH_3$. Show the reaction steps

Grignard reagent = methyl magnesium chloride

$CH_3CH_2CH_2CH_2C{=}OCH_2CH_2CH_3 + CH_3MgCl \longrightarrow$

$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2C{-}OH$



$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2OH + Mg(OH)Cl_2$

Nonanol

3) Discuss the industrial manufacture of ethanol, showing all reaction equations and necessary enzymes and temperature of reaction.

Ethanol can be gotten from starch by the biological process known as fermentation. To start this process the starch containing material is crushed with malt to 60°C for a specific period of time. It is then converted to maltose by the enzyme diastase contained in malt.

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

carbohydrate → maltose

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

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

maltose glucose

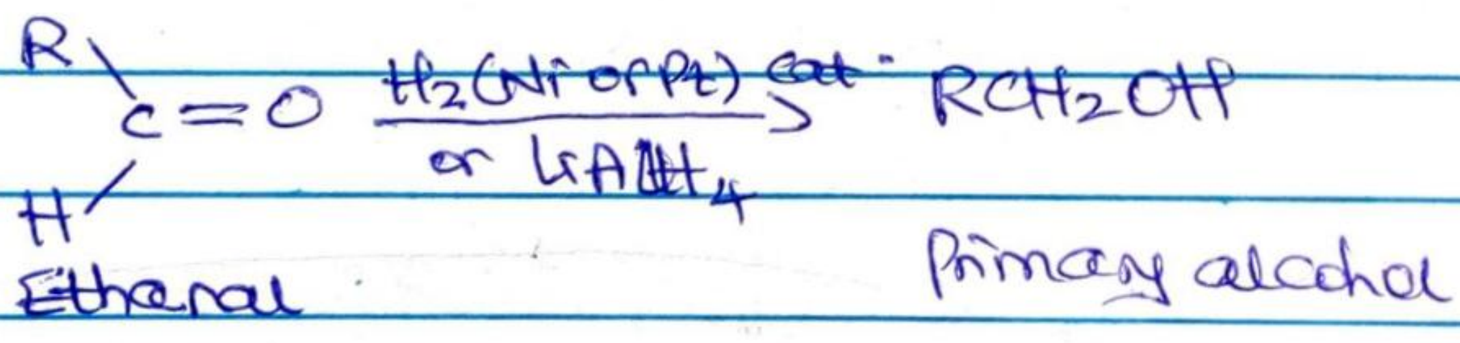
The glucose at constant temperature of 15°C is then converted into ethanol by the enzyme Zymase also contained in yeast

$$C_6H_{12}O_6 \xrightarrow[\text{Zymase}]{15^\circ C} 2CH_3CH_2OH + 2CO_2$$

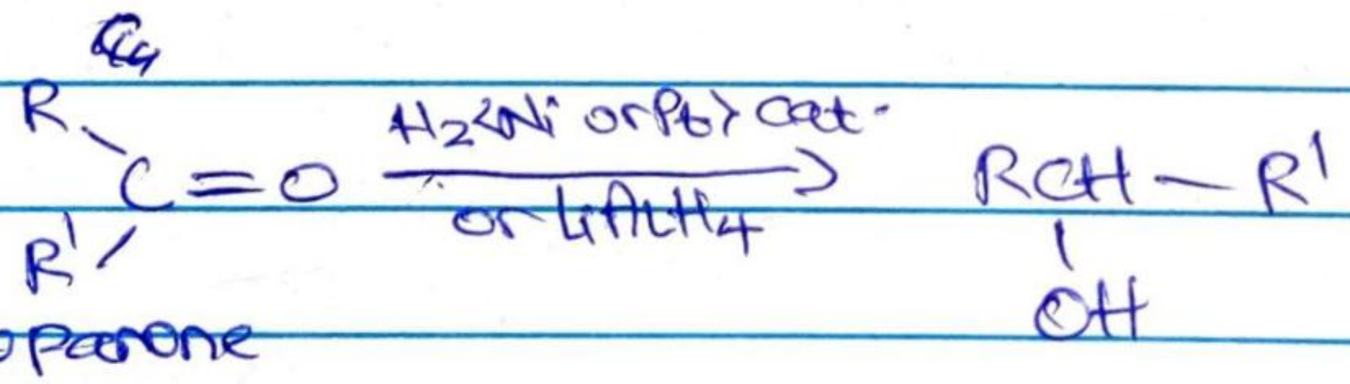
Glucose Ethanol

4) Determine the product obtained in the reduction of alkanone and alkanal. Use a specific example for each and show the equation of reaction.

Alkanones and alkanals are reacted with hydrogen in the presence of a platinum or nickel catalyst or with aluminium isopropoxide (the Meerwein–Ponndorf reaction) or with complex metal hydride, such as Lithium tetrahydridoaluminate(III) $LiAlH_4$ and is reduced to secondary and primary alcohols respectively.



Ethanal Primary alcohol



Propanone

$R = CH_3$

$R' = CH_3$

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