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CHM 102 ASSIGNMENT

1. **Major classification of Alcohols and examples**
   a) Classification based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. If the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two, it is called a primary alcohol (1^0). If it is one hydrogen atom, it is called a secondary alcohol (2^0) and if there is no hydrogen atom, it is tertiary alcohol (3^0). Examples are; CH_3OH-methanol (1^0), CH3CH2OH(ethanol) 1^0.
   b) Classification based on the number of hydroxyl group they possess. Monohydric alcohols have one hydroxyl group present. Dihydric alcohols or glycols have two hydroxyl groups present while trihydric alcohols or triols have three hydroxyl groups present in the alcohol structure. Polyhydric alcohols or polyols have more than three hydroxyl groups present. Examples are; CH3CH(OH)CH2CH(OH)CH2CH3 hexane-2,4-diol (Dihydric alcohol) CH3CH2CH2OH propanol(monohydric alcohol).

2. **Grignard synthesis of alcohol.**

$CH_3CH_2CH_2MgCl + CH_3CH_2CH_2CH_2C{=}OCH_2CH_2CH_3$

(Grignard reagent;
Propyl magnesium chloride)

$$CH_3CH_2CH_2CH_2 - C(-CH_2CH_2CH_3)(-OMgCl)-CH_3CH_2CH_2$$

React with water (H^+OH^-) and dilute acid

$Mg(OH)Cl + CH_2CH_2CH_3$

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$CH_3CH_2CH_2CH_2 — C — OH$

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$CH_3CH_2CH_2$

4-propyl octan-4-ol.

3. Industrial manufacture of ethanol

i) Carbohydrate such as starch is broken down by diastase contained in malt at a temperature of 60^0c to give maltose.

Equation for the reaction: $2(C_6H_{10}O_5)_n + n\ H_2O \longrightarrow n\ C_{12}H_{22}O_{11}$

carbohydrate 60^0c/diastase maltose

ii) Maltose is broken down into glucose by maltase found in yeast at a temperature of 15^0c to give glucose.

Equation: $C_{12}H_{22}O_{11} + H_2O \longrightarrow 2C_6H_{12}O_6$

Maltose 15^0c/maltase glucose

iii) Glucose is converted to ethanol at constant temperature of 15^0c by enzyme zymase also contained in yeast.

Equation: $C_6H_{12}O_6 \longrightarrow 2CH_3CH_2OH + 2CO_2$

Glucose 15^0c/zymase Ethanol

4) Reduction of aldehydes and ketones.

Aldehydes and ketones are reduced to primary and secondary alcohols respectively by reaction with hydrogen in the presence of a platinum or nickel catalyst or with complex metal hydride, such as lithium tetrahydridoaluminate (III) ($LiAlH_4$).

$RCHO \xrightarrow{H_2\text{(Ni or Pt) cat. or } LiAlH_4} RCH_2OH$

aldehyde primary alcohol

$R`RCO \xrightarrow{H_2\text{(Ni or Pt) cat. or } LiAlH_4} R`RCHOH$

Ketone secondary alcohol

Specific examples

CH_3CH_2CHO $\underline{H_2(Ni\ or\ Pt)\ cat.}$ CH_3CH_2OH
propanal or $LiAlH_4$ Propanol

$(CH_3)_2CO$ $\underline{H_2(Ni\ or\ Pt)\ cat.}$ $(CH_3)_2CHOH$
propan-2-one or $LiAlH_4$ propan-2-ol