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1. Classification of alcohols:

a. Alcohols are classified based on the number of hydrogen atoms attached to the carbon atom carrying the OH functional group (hydroxyl group). If the number is 2 or 3 hydrogen atoms, it is called a primary alcohol (1°). If it is only 1 hydroen atom, it is a secondary alcohol (2°). If it is 0, that is there is no hydrogen atom attached to the carbon atom carrying the hydroxyl group, it is a tertiary alcohol (3°). Example, $(CH_3)_3C-OH \Rightarrow 3°$ (tertiary)

b. They are also based on the number of hydroxyl groups they possess. If the alcohol has one hydroxyl group, it is a monohydric alcohol. If it has two, it is a dihydric alcohol or glycol. If it has three, it is a trihydric alcohol or triol. If it has more than three, it is a polyhydric alcohol or polyol. Example, $HOCH_3CH_2OH$ is a glycol.

2. The water solubility of alcohols decreases with increasing relative molecular mass. Lower alcohols with three carbon atoms are soluble in water because they can form hydrogen bonds with water molecules. Simple and polyhydric alcohols are soluble in water because of their ability to form hydrogen bonds with water molecules. All monohydric alcohols are soluble in organic solvents.

3. Industrial Preparation of Ethanol:
Ethanol is prepared by the biological process of fermentation of carbohydrates (starch, sugar, cellulose). It goes as follows:

a. The starch containing material is reacted with yeast which contains an enzyme called diastase that converts starch to maltose

over a period of time and at a temperature of 60°C.

$2(C_6H_5O_{10}) + nH_2O \xrightarrow{60°C/\text{diastase}} nC_{12}H_{22}O_{11}$

starch → maltose

b. The maltose is reacted with yeast, which also contains the enzyme maltase that converts maltose to glucose at a temperature of 15°C

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

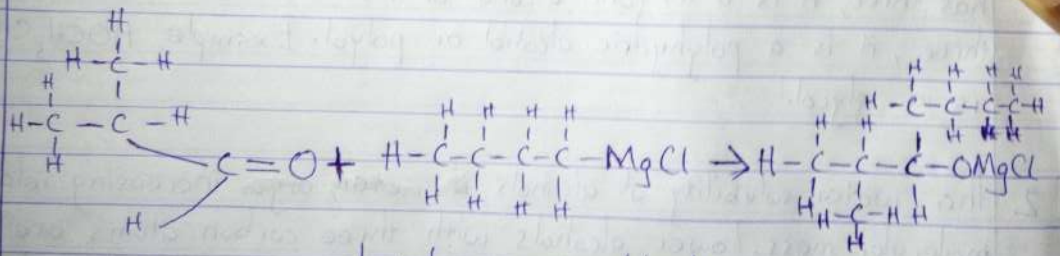
maltose → glucose

c. The glucose is then reacted with yeast, which also contains an enzyme called zymase that converts glucose to ethanol at a temperature of 15°C.

$C_6H_{12}O_6 \xrightarrow{15°C,\ \text{zymase}} 2C_2H_5OH + 2CO_2$

glucose

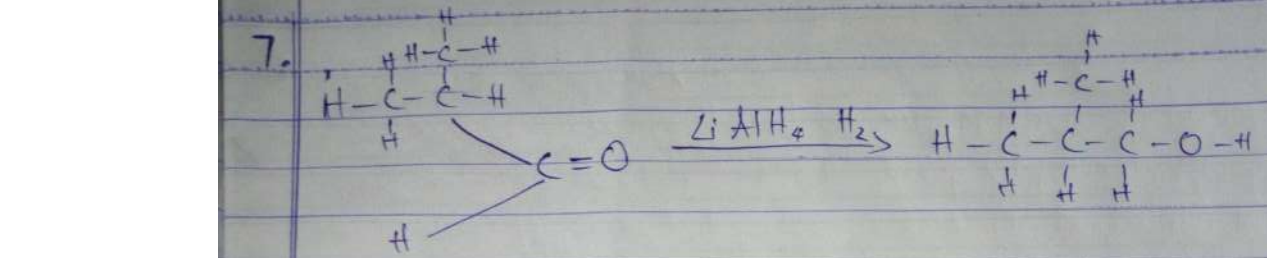
4.



2-methyl propanal + butylmagnesium chloride → (dil. acid) → 2,2-butylmethylpropanol + MgClOH

5. Not possible (no answer)

6. It (2-methylpropanone) cannot be reduced.

7. 

2-methylpropanal — 2-methylpropenol

~~8. $CH_3CH_2CH_2OH + H_2SO_4 \longrightarrow$~~

8. $CH_3CH_2CH_2OH \longrightarrow CH_3CH(OH)CH_3$

Propan-1-ol to propan-2-ol

$CH_3CH_2CH_2OH + H_2SO_4 \longrightarrow CH_3CH_2CH_2OH_2OSO_3H$

propen-1-ol

$\downarrow -H_2O$

$CH_3CH_2CH_2OSO_3H$

$\downarrow -H_2SO_4$

$CH_3CH=CH_2 + H_2O$

$\downarrow$

$CH_3CH(OH)CH_3$ (propan-2-ol)