1a Classification based on the number of hydrogen atoms attatched to the carbon atom containing the hydroxyl group. They are :-

i Primary alcohol (1°) - The number of hydrogen atoms attatched to the carbon atom bearing the hydroxyl group are three or two e.g CH_3OH (Methanol)

ii Secondary alcohol (2°) - In this, One hydrogen atom is attatched to the carbon atom bearing the hydroxyl group, example :- $CH_3CH(OH)CH_3$ (Propan-2-ol)

iii Tertiary alcohol (3°) - In this, there is no hydrogen atom attatched to the carbon atom bearing the hydroxyl group. e.g $(CH_3)_3C-OH$ (2-Methylpropan-2-ol

b Classification based on the number of hydroxyl groups they possess. They are :-

i Monohydric alcohol - They have one hydroxyl group present in the alcohol structure. e.g $CH_3CH_2CH_2OH$ (Propanol)

ii Dihydric alcohols (glycols) - They have two hydroxyl groups present in the alcohol Structure. Example - $HOCH_2CH_2OH$ (Ethane-1,2-diol).

iii Trihydric alcohols (triols) - They have three hydroxyl groups present in the alcohol structure. Example - $OHCH_2CH(OH)CH_2OH$ (Propan-1,2,3-triol)

iv Polyhydric alcohols (polyols) - They have more than three hydroxyl groups. Example -

$CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$ (Heptane-2,3,4,5,6-pentaol

2. Solubility of alcohol:- The water solubility of alcohols decreases with increasing relative molecular mass. Lower alcohols with up to three carbon atoms in their molecules are soluble in water these lower alcohols can form hydrogen bond with water molecules.

All monohydric alcohols are soluble in organic solvents The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with molecules.

3 Industrial production of ethanol

(i) Carbohydrates (e.g starch) are major group of natural compound that can be made to yield ethanol by the biological process of fermentation. The biological catalysts, enzymes found in yeast break down the carbohydrate molecules into ethanol to give a yield of 95%. On warming malt with starch containing meterials (e.g cereals) to 60°C for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.

$$2(C_6H_{10}O_5)n + nH_2O \xrightarrow{60°C\ /\text{diastase}} n\,C_{12}H_{22}O_{11}$$

Carbohydrate, maltose

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

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

maltose, glucose

iii The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme zymase contained also in yeast.

$$C_6H_{12}O_6 \xrightarrow{15°C\ /\text{zymase}} 2CH_3CH_2OH + 2CO_2$$

Glucose, ethanol

4 ~~$(CH_3)_2CHCH=O$ ⟶~~

4 $(CH_3)_2CHCH=O + C_4H_9MgCl \longrightarrow C_4H_9CH(CH_3)_2CH-OMgCl$

$+ H_2O$

↓ Dilute acid

$C_4H_9CH(CH_3)_2CHOH + MgClOH$

6 $(CH_3)_2CHCH=O \longrightarrow (CH_3)_2CHCH_2OH$

7 $(CH_3)_2CH_2C=O \longrightarrow (CH_3)_2CH_2CH_2OH$

8 Scheme of conversion of Propan-1-ol to propan-2-ol

This involves two processes :-

i Dehydration of propan-1-ol to propene

- When propan-1-ol is treated with tetraoxosulphate(VI) (H_2SO_4) dehydration occurs due to which a water molecule from propan-1-ol gets eliminated
- Due to this propan-1-ol gets converted to propene

$CH_3CH_2CH_2OH + H_2SO_4 \longrightarrow CH_3CH=CH_2$

ii Hydrolysis of Propene to propan-2-ol

- Propene can be hydrolysed to propan-2-ol with a mechanism called Markovnikoff's addition.
- In this case the unsymetrical reagent used is H_2O which is composed of the H^+ and OH^- part.
- Due to hydrolysis of water the negative part attatches itself to the propene thus convers it to propan-2-ol.

$CH_3CH=CH_2 + H_2O \longrightarrow CH_3CH(OH)CH_3$