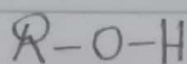


Alcohols



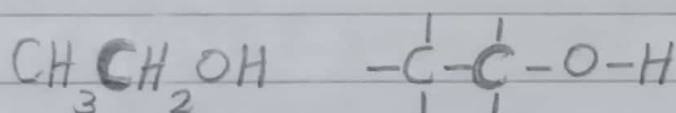
R is an alkyl (i.e., aliphatic),
or substituted alkyl gp.

R may be primary (1°), secondary (2°),
or tertiary (3°) (leading to 1° , 2° & 3°
alcohols, respectively).

R may be open chain or cyclic

R it may contain a double bond,
a halogen atom,
or an aromatic ring

1. Examples: primary 1° alc.s:



(the alkan[e], alkan[ol])

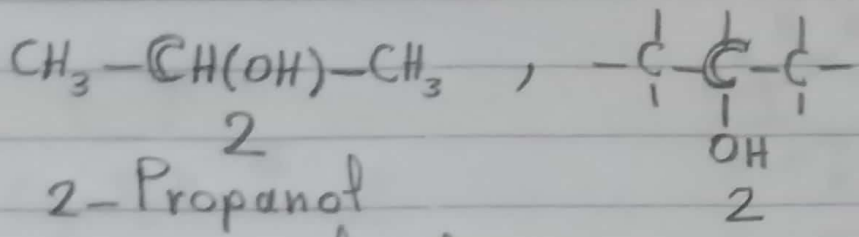
Ethan[ol], Ethyl alcohol

1° alcohol, monohydric alc. (i.e., has
one hydroxyl gp.)

1° (the C atom that carry the OH gp. is
directly attached to only one C at.)

2 alc.

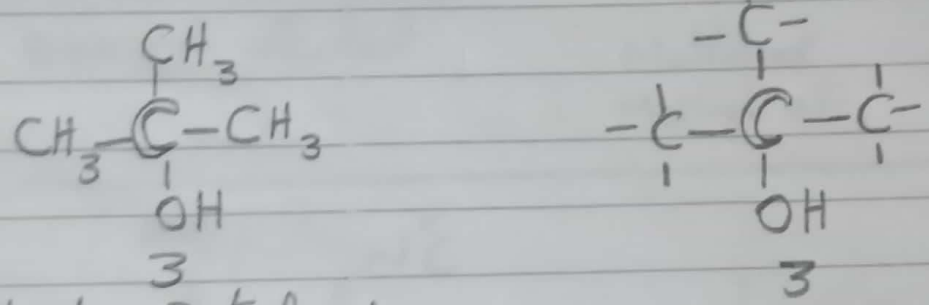
2. secondary 2° alc.s :



2-Propanol
Isopropyl alc.

2° alc. (the C at. carrying the OH gp. is directly attached to two C at.s)

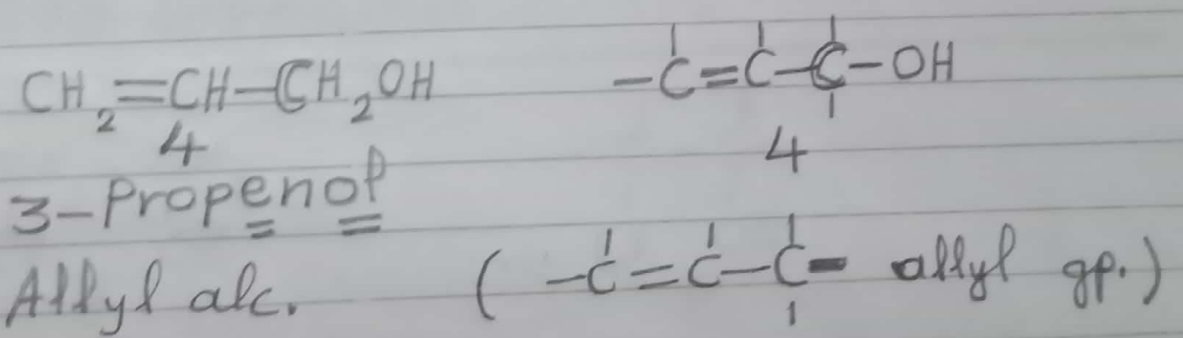
3. tertiary 3° alc.s :



tert-Butyl alc.

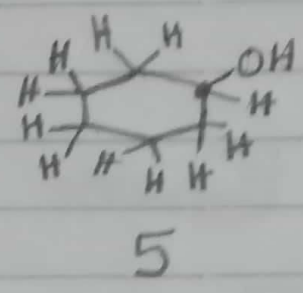
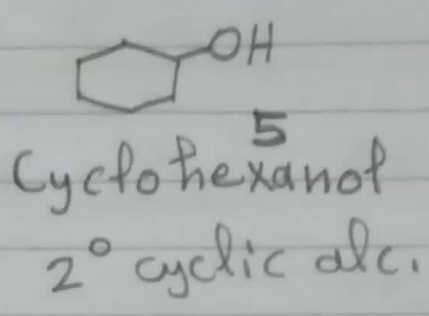
2-Methyl-2-propanol

3° alc. (the C at. carrying the OH gp. is directly attached to three C at.s)

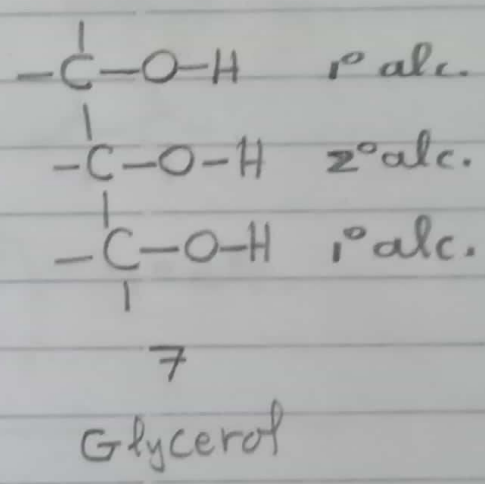
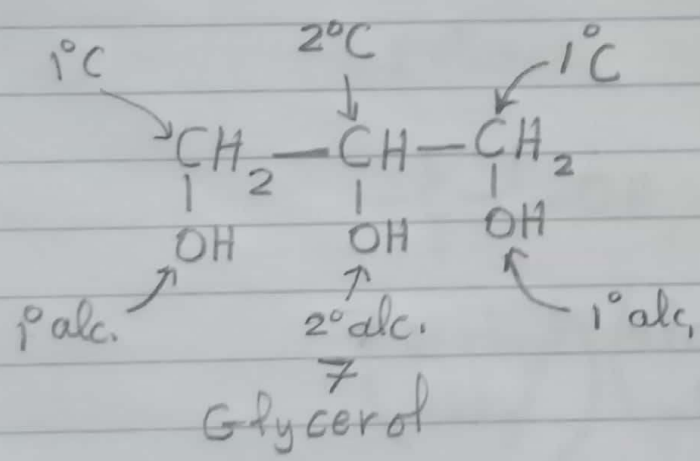
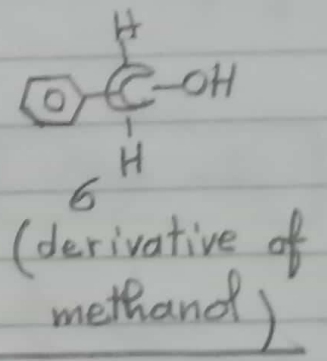
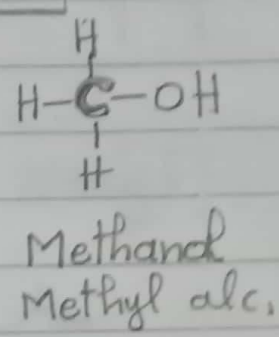
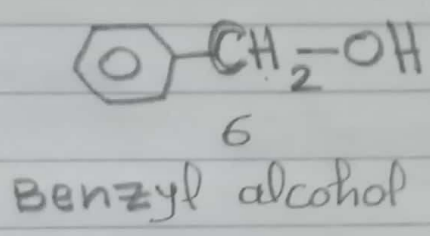


3 alc.

cyclic alc.s :

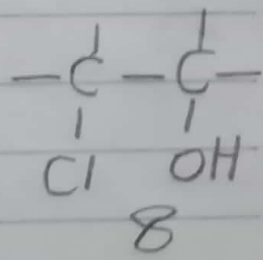
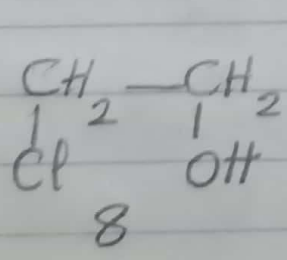


aromatic derivative of alc.s :



IUPAC (1,2,3-Trihydroxypropane)

 com 1,2,3-Propanetriol



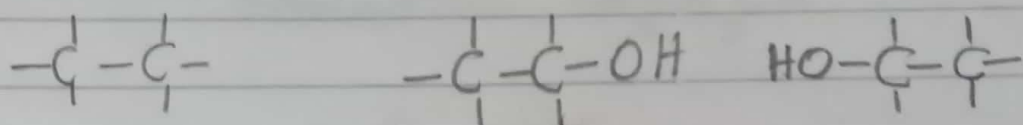
Ethylene chlorohydrin (β -Chloroethyl alc.).

4 alc.

2. Nomenclature:

2.1 IUPAC: Alkan[e] \rightarrow Alkan[ol]

Ethan[e] \rightarrow Ethan[ol]

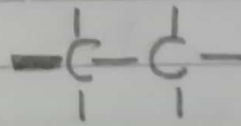
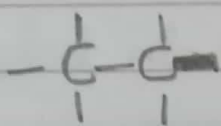
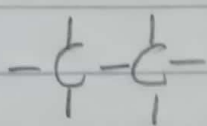


2.2 Common:

Ethane

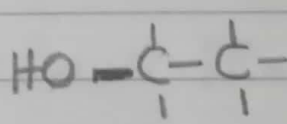
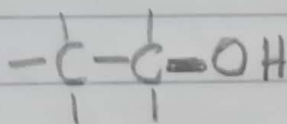
Ethyl

alkyl alc.

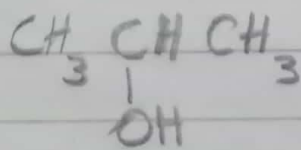


Ethane

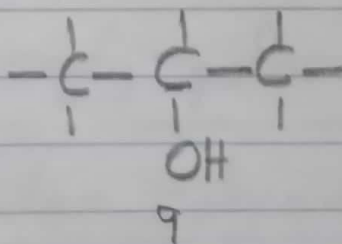
Ethyl gp.



(Ethyl) (alcohol) 1° alc.
(Alkyl) (alcohol)



2-Propanol
Isopropyl alc.
 2° alc.



2° alc.

5 alc.

3. Physical properties of alcohols ;

3.1 Form (State) ;

3.1.1 Liquids ; e.g., Methanol CH_3OH

Ethanol $\text{CH}_3\text{CH}_2\text{OH}$

3.1.2 Solids ; e.g., $\text{C}_{16}\text{-OH}$

3.2 Colour ; Liquid alcs are colourless.

Solid alcs are white.

3.3 odour ; Most alcs have odour,

liquids have the strongest

odour.

3.4 Polarity ; polar, the (-O-H) gp. is

strongly polar.

3.5 Solubility in polar solvents, e.g., water

$(\text{C}_1\text{-OH}) - (\text{C}_4\text{-OH})$ are soluble

(miscible) in water. Higher alcs

6 alc.

of $>C_4OH$ are less soluble in water,
(the longer the ^{nonpolar part} hydrocarbon part, R), of the
alc., the lesser the solubility
(miscibility) in water.

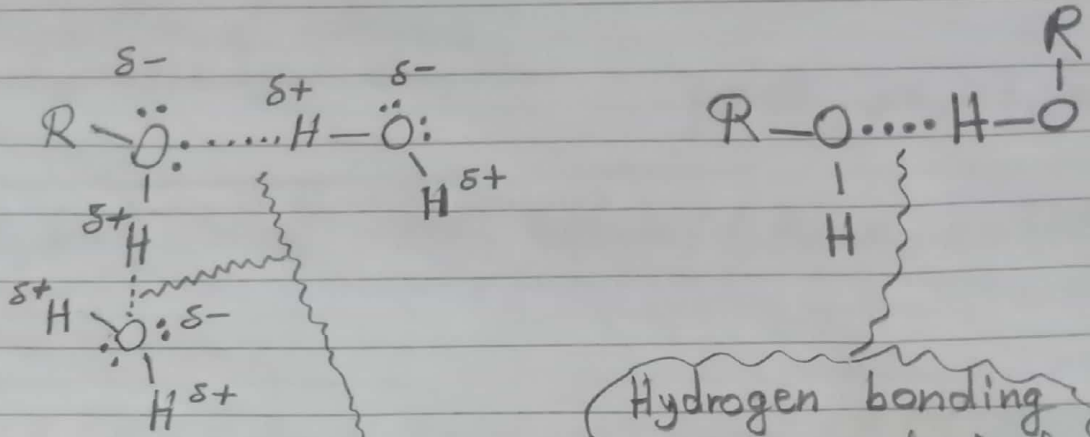
3.7 Melting & boiling points of alcs.;

Due to the polarity and intermolecular
hydrogen bonding between the alcohol
molecules, the melting and boiling
points of alcohols are, relatively,
high. (they are clearly higher than
those of the corresponding hydrocarbons).

3.8 Effect on litmus paper;

Alcohols are neutral.
[red \rightarrow red & blue \rightarrow blue]
∴ neutral.

Hydrogen bonding ; Association ;

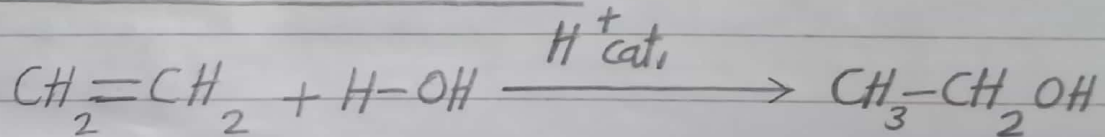


Hydrogen bonding between the alcohol and water helps in solvation.

Hydrogen bonding between alcohol molecules lead to high boiling and melting points.

4. Industrial source of alcohols ;

4.1 Hydration of alkenes ;



Ethene

Ethylene

Alkene

Ethanol

Ethyl alc.

Alcohol

• Ethyl alcohol is also, *

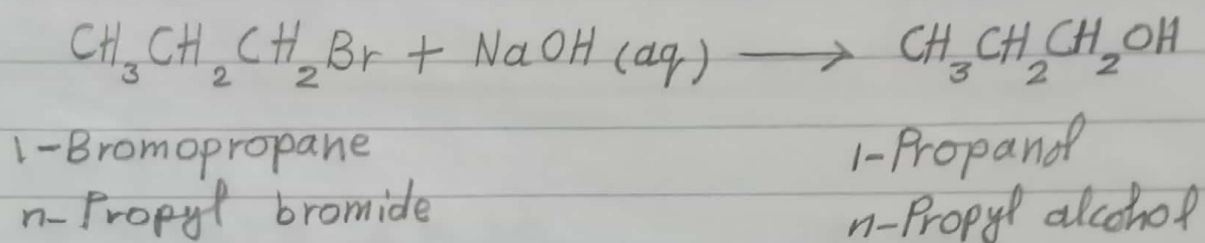
8alc.

5. Preparation of alcohols:

5.1 Hydration of alkenes:

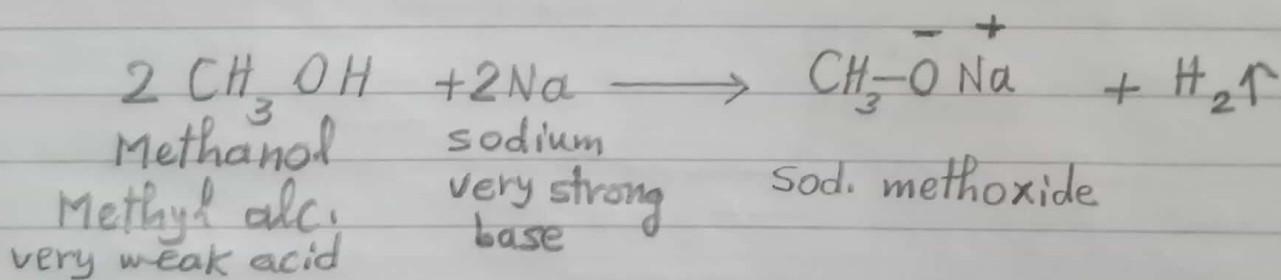
انظر آذر ص (7alc.)

5.2 Hydrolysis of alkyl halides ($R-X$, $X=\text{halogen}$):

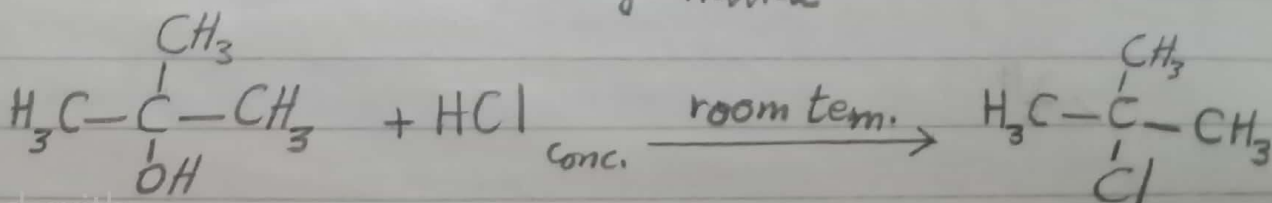
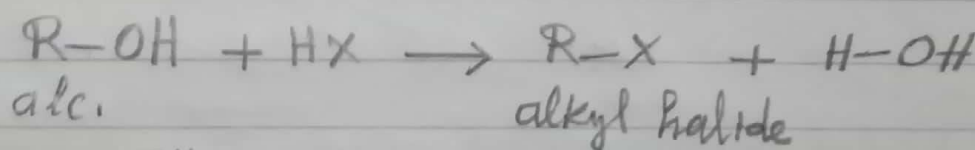


6. Reactions of alcohols:

Reaction as very weak acids ($R-O-H \rightleftharpoons R-O^- + H^+$):



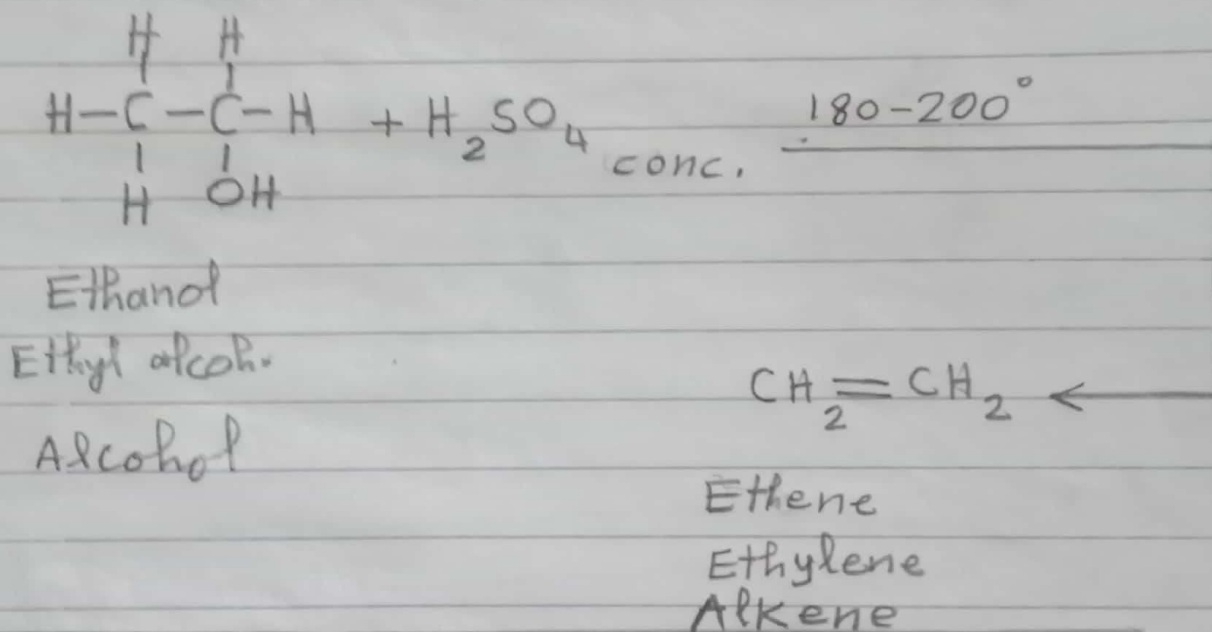
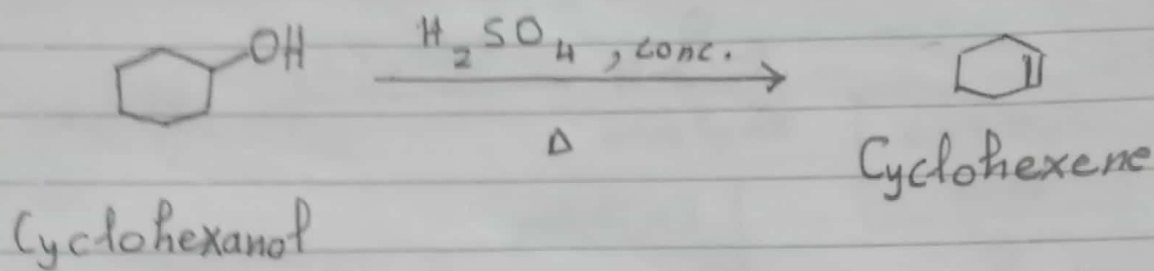
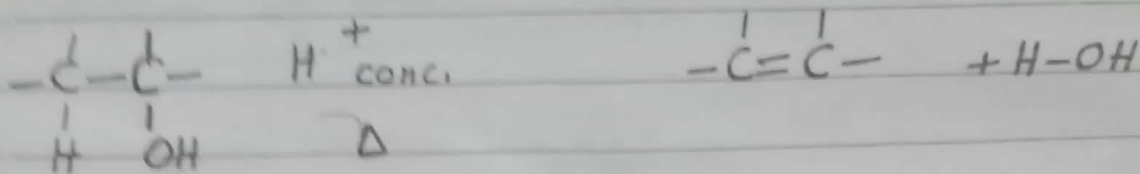
6.1 Reaction with hydrogen halides (HX):



tert-Butyl alc.

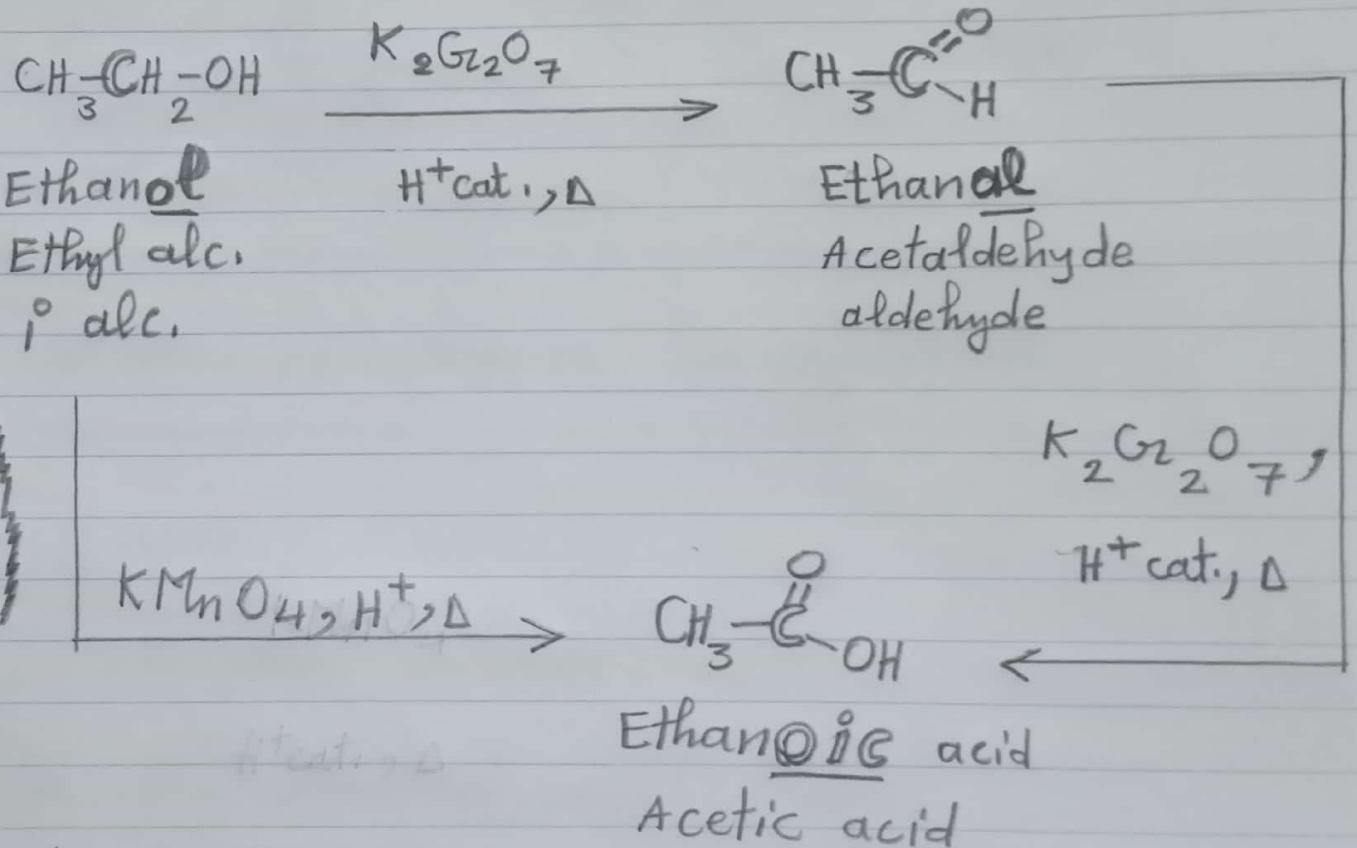
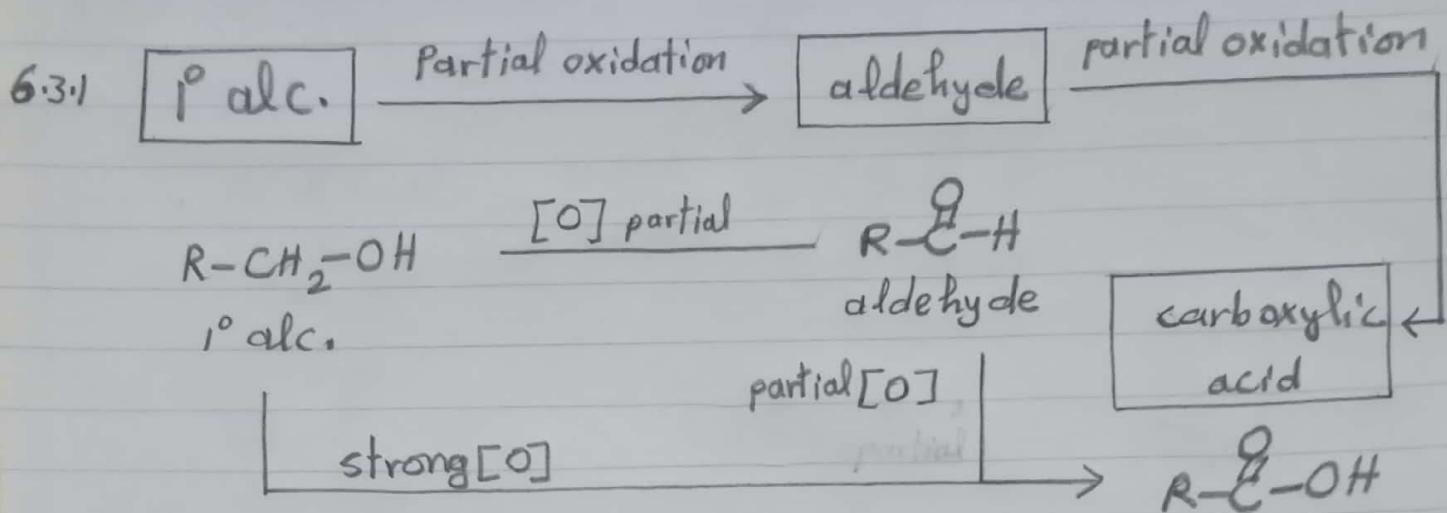
tert-Butyl chloride

5.2 Dehydration of alcohols;



10 alc.

6.3 Oxidation of alcohols : (with keeping the same carbon number)



The number and order of carbon atoms is kept

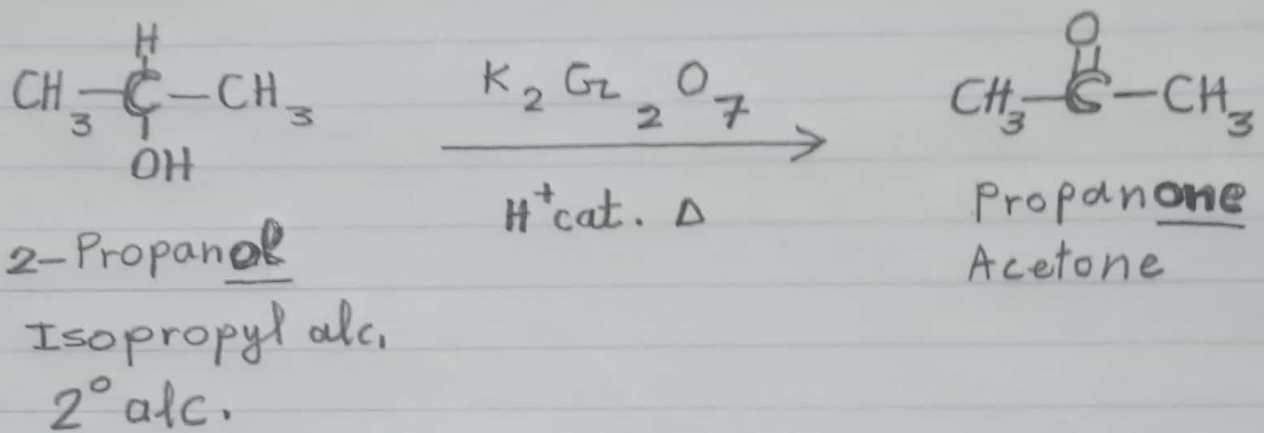
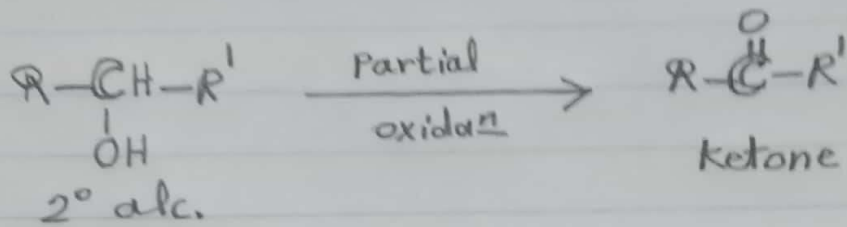
$KMnO_4$ potassium permanganate is a strong oxidizing agent. Its aqueous solution is pink, which is removed after acting as oxidizer.

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البرتقالي

$K_2Cr_2O_7$ potassium dichromate is of medium oxidizing strength. Its aqueous orange colour is removed after acting as oxidizer.

كرومات البوتاسيوم
البرتقالي

63.2 $\boxed{2^\circ \text{ alc.}}$ $\xrightarrow[\text{oxidation}]{\text{partial}}$ $\boxed{\text{ketone}}$ with the same C number



3° alc.s decompose on oxidation.

7. uses :

- 1 Organic solvents.
 - 2 Pharmaceutical applications.
 - 3 Perfumes.
-