الوحدة V كيمياء عضوية IV ١٥ محاضرة الأسبوع ٢٣٤٥

Subject: Alcohols د. محمد الأشرم ٢٠٢١ / ١٢ / ١٩

* Functional group is OH, binded with R (aromatic / alkyl)

types of alcohol:-

primary 

secondary 

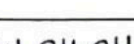
tertiary 

Nomenclature system:-

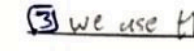
1. The main chain should contain OH
2. carbon atom which is binded with OH should take the less number.
3. we use the end -ol.

$CH_3CH_2CH_2OH$ 1-propanol (n-propyl alcohol)

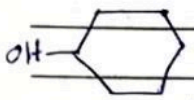
structural isomer



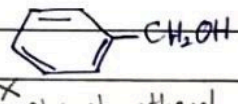
CH_3CHCH_3 (OH) 2-propanol (isopropyl alcohol)



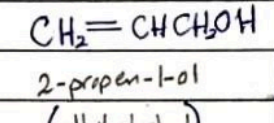
2-methyl-1-propanol (isobutyl alcohol)



cyclohexanol (cyclohexyl alcohol)

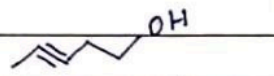


phenyl methanol (benzyl alcohol)

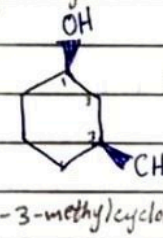


2-propen-1-ol (allyl alcohol)

note:- the position of OH has higher priority than double or triple bonds

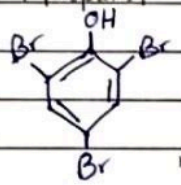


3-pentyne-1-de

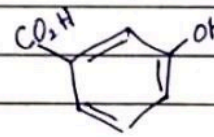


cis-3-methylcyclohexanol

$BrCH_2CH_2CH_2OH$ 3-bromo-1-propanol

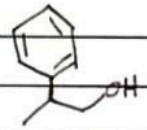


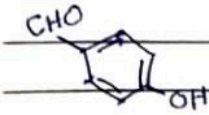
2,4,6-tribromophenol



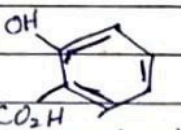
m-hydroxybenzoic acid 3-hydroxybenzoic acid

2-phenylpropanol





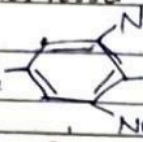
p-hydroxybenzaldehyde



o-hydroxybenzoic acid (salicylic acid)

Properties of alcohols and phenols:-

1. form H-bonds
2. have high boiling points.
3. have high solubility in water, as they form H-bonds with water.
4. as the carbon chain gets greater, the solubility becomes lesser
5. alcohols are acidic.



Picric acid

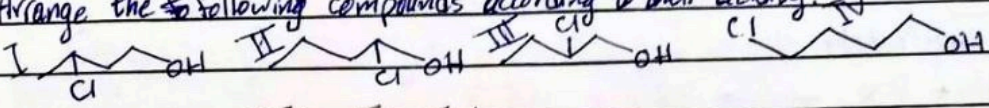
	bp	solubility
methanol	65°C	completely miscible
propanol	97°C	highly soluble
1-pentanol	137.9°C	soluble

Subject : Alcohols

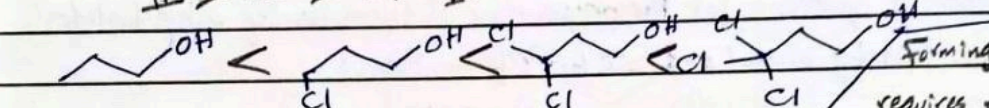
*Phenols are higher acidic than alcohols. $RO-H \rightleftharpoons \underset{\text{alkoxide}}{RO^-} + H^+$

*Negative charge on O in alkoxide is localized, unlike phenoxides. $ArO-H \rightarrow \underset{\text{phenoxide}}{ArO^-} + H^+$ Phenoxide is more stable than alkoxide.

Arrange the following compounds according to their acidity:



II > III > I > IV



I > III > II

Forming alkoxide:- by reacting alcohol with Na/k/ metal hydride. $2RO-H + 2K \rightarrow 2RO^-K^+ + H_2$

Reactions of alcohols:- $RO-H + NaH \rightarrow RO^-Na^+ + H_2$

Forming phenoxide requires reaction of Phenol with NaOH

Deactivating groups increase the acidity of alcohols and vice versa

[1] dehydration: → alkenes (elemination reaction)

$CH_3CH_2OH \xrightarrow{H^+,\ 180°C} CH_2=CH_2 + H_2O$

$CH_3C(OH)(CH_3)CH_2CH_3 \xrightarrow{H^+,\ heat} CH_2=C(CH_3)CH_2CH_3$ (minor) + H_2O or $CH_3C(CH_3)=CHCH_3$ (more stable, major) + H_2O

The major compound formed by dehydration is when there are more alkyl groups around double bond

[2] reactions with hydrogen halides: (substitution reaction) HCl/HBr/HI

$R-OH + H-X \xrightarrow{?} R-X + H_2O$ → alkyl halide

$(CH_3)_3COH + HCl \xrightarrow[15\ min]{22°C} (CH_3)_3C-Cl + H_2O$ (S_N1 mechanism)

tertiary alcohol

$CH_3(CH_2)_3CH_2OH + HCl \xrightarrow[several\ hours]{ZnCl_2,\ heat} CH_3(CH_2)_3CH_2Cl + H_2O$ (S_N2 mechanism)

primary alcohol

*Secondary alcohols react at intermediate rates by both S_N1 and S_N2 mechanism

Dehydration of alcohols can be occured in E_1 or E_2 mechanisms

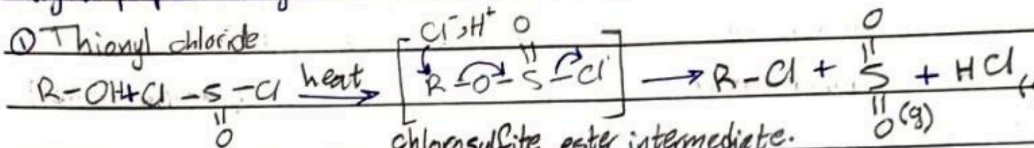
١٧ جمادى الأولى ١٤٤٢هـ   كيمياء عضوية ١٨   الوحدة ٧

٢١ / ١٢ / ٢٠٢١م   د. محمد الأشرم

Subject: Alcohols

ways to prepare alkyl halide from alcohol:-

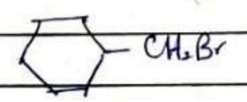
① Thionyl chloride

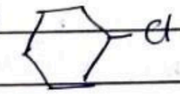


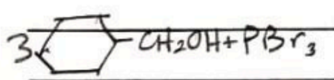
② Phosphorus halides also convert alcohols to alkyl halides (X = Cl or Br)

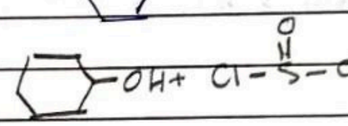
$3R\text{-}OH + PX_3 \longrightarrow 3RX + H_3PO_3$

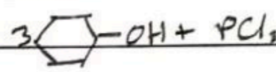
Write balanced equations for the preparation of the following alkyl halides from the corresponding alcohol and $SOCl_2$, PCl_3 or PBr_3:

a) 

b) 

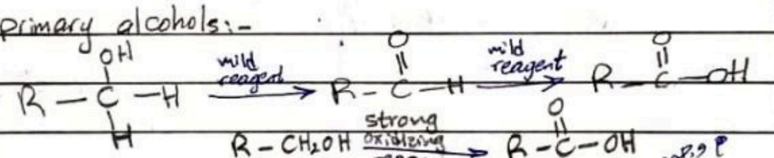






③ oxidation: → aldehydes, ketones and carboxylic acid.

primary alcohols:-

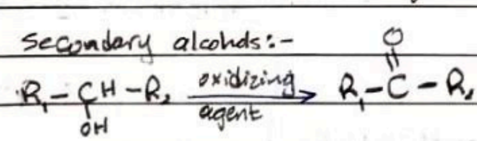


Mild reagents such as PCC convert primary alcohols into aldehydes.

$25°C$ CH_2Cl_2

PCC:- Pyridinium chlorochromate.

secondary alcohols:-



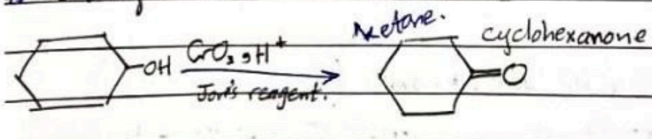
Oxidizing agents:-

strong) ① chromium oxide CrO_3, H_2SO_4 (jones reagent)

② Potassium permanganate $KMnO_4$

③ Potassium dichromate $K_2Cr_2O_7$

* Tertiary alcohols can't be oxidized.



note - Jon's reagent is CrO_3 in the presence of H_2SO_4 or acetone solvent.

4methyl-1-octanol with Jones' reagent → 4-methyloctanoic acid

4Phenyl-2-butanol with PCC → 4Phenyl-2-butanone.