M T W T F S DATE: 124

CHAPTER :-

ALCOHOLS, PHENOLS AND ETHERS

Alcohols :- hydroxy derivatives of alkanes / alkyl derivative of H_2O.

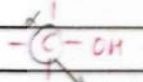
Phenols :- hydroxy derivatives of benzene

→ Distinguishing Alcohols and Phenols :-

• R-OH :-

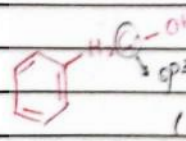
• OH is bonded to sp^3-hybridized carbon

(1) $R-CH-H_2C-OH$ (sp^3)



alcoholic carbon (sp^3-hybridized)

(3)



sp^3-hybridized carbon (alcohol).

* OH is bonded to sp^2-hybridized but sp^2-hybridized carbon is not a part of benzene ring.

(2) $R-CH=CH-OH$ (sp^2)

→ Ar-OH

OH bonded to sp^2-hybridized carbon; then it is a

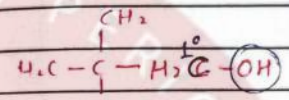
M T W T F S DATE: 125

phenol. (and sp^2-hybridized carbon is a part of benzene ring)

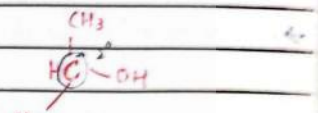
→ Classification of Alcohols :

1. Monohydric Alcohols :- (having one OH group)

Monohydric R-OH → 1°, 2°, 3°

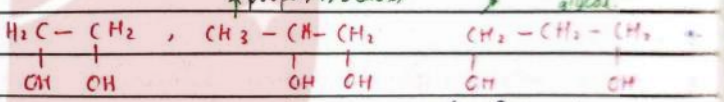


(1° - R-OH)



(2° - ROH)

2. Dihydric Alcohols :- (having 2 -OH groups)



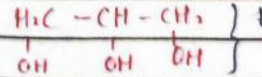
(glycol) (ethylene glycol)

(glycol) (propylene glycol)

(not a glycol) (1,3-propanediol)

Glycol → a dihydric alcohol
↳ must have OH groups on the adjacent C-atoms.

3. Polyhydric Alcohols :- (having more than two OH groups)



trihydric alcohol.

(Glycerol / Glycerine)

→ also ns glucose and fructose have OH groups along

Checked By:

M T W T F S DATE: 126

with aldehyde and ketone therefore they can also be included in alcohol family.

→ Methanol :

→ also called :

i) CH_3OH ii) methyl alcohol iii) carbinol

iv) wood spirit.

→ can be prepared by ;

$$CO + 2H_2 \xrightarrow[450°,\ 200\ atm]{ZnO + Cr_2O_3} CH_3OH$$

→ Ethanol

→ also called ;

i) C_2H_5OH ii) ethyl alcohol iii) spirit of wine

iv) grain alcohol.

→ most commonly occuring alcohol.

→ Before WW-II, 75% of ethanol was prepared by fermentation but now less than 10% is prepared by this method.

Fermentation :

i) a biochemical process

ii) occurs in the presence of enzymes

iii) enzymes :- secreted by yeast. (no yeast, no enzyme,

M T W T F S DATE: 127

iv) Anaerobic process v) exothermic process.

Necessary Conditions :- (for fermentation)

i) Proper aeration (if O_2 level inc↑, aerobic respiration occurs)

ii) dilution of solution (enzymes become inactive in the concentrated soln)

iii) Optimum temperature (25°C – 35°C)

iv) absence of any preservative [preservatives kill micro-organisms (yeast)]

From Molasses;

$$\underset{\text{(Molasses)}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[\text{(Yeast)}]{\text{Invertase}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + \underset{\text{(Fructose)}}{C_6H_{12}O_6}$$

FG isomers of each other

$$C_6H_{12}O_6 \xrightarrow[\text{Yeast}]{\text{Zymase}} 2\underset{\text{ethanol}}{C_2H_5OH} + 2CO_2$$

From Starch (Potato, Barley and Maize) → main sources.

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow[\text{(Barley)}]{\text{Diastase}} \underset{\text{(Maltose)}}{C_{12}H_{22}O_{11}} \xrightarrow[\text{(Yeast)}]{} $$

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{Yeast}]{\text{Maltase}} 2C_6H_{12}O_6 \text{ (Glucose)}$$

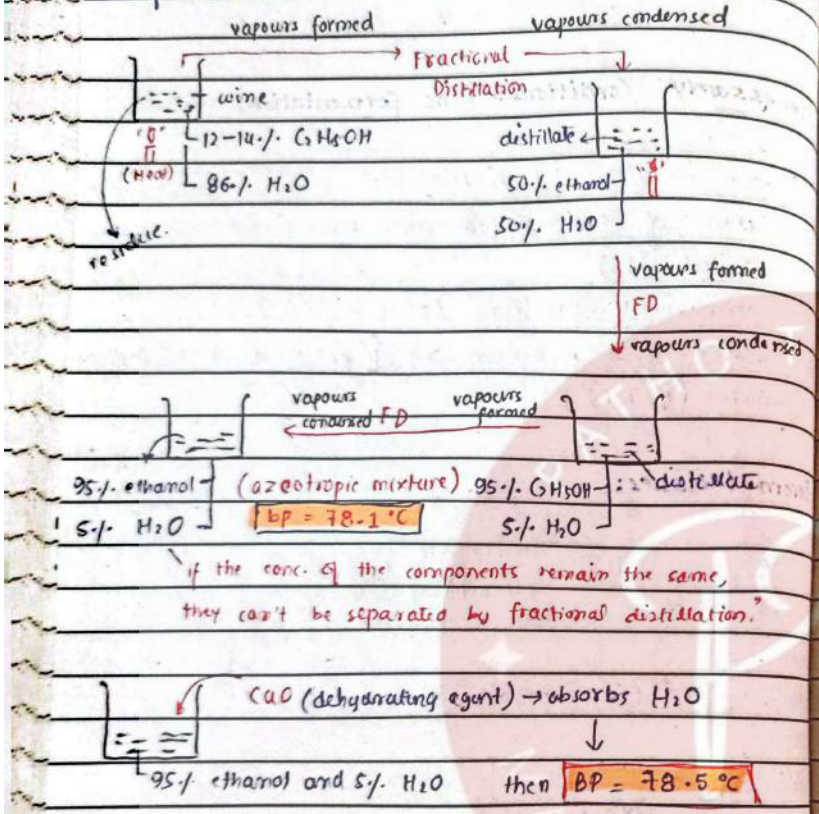
$$C_6H_{12}O_6 \xrightarrow[\text{Yeast.}]{\text{Zymase}} 2C_2H_5OH + CO_2$$

(12–14% ethanol)

↳ rest of 86% is H_2O

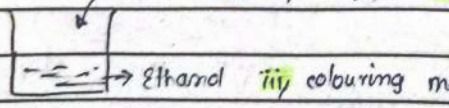
Checked By: _____

Rectified Spirit:



if the conc. of the components remain the same, they can't be separated by fractional distillation."

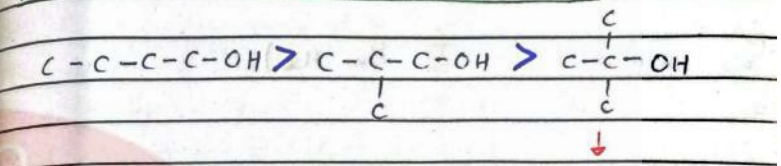
Methylated Spirit:- (Denatured Spirit)



this whole mixture is called "methylated spirit."

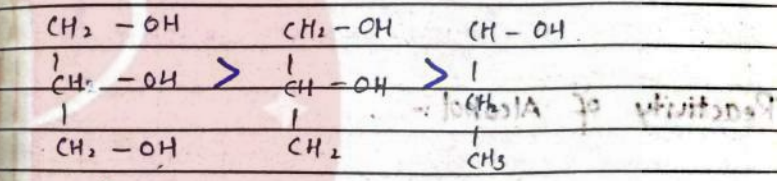
→ Boiling Point of Alcohols:

BP ∝ molecular mass ∝ 1 / No. of R groups



→ more R groups, least surface area, least vdF and hence least boiling point.

BP ∝ No. of Hydrogen bonds (No. of OH groups)



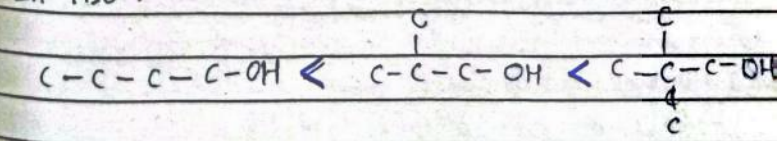
more OH groups so more H-bonds.

BP ∝ molecular mass

$CH_3OH < C_2H_5OH < C_3H_7OH < C_4H_9-OH$

→ Solubility :-

In H_2O :



Checked By:

M T W T F S DATE: 130

C-C-C-C-OH (greater non-polar surface area, greater non-polar character and least solubility in H_2O.)

Solubility $\propto$ No. of $\bar{O}H$

Solubility $\propto \frac{1}{\text{molecular mass}}$

Solubility $\propto$ No of branches.

In Non-Polar Solvents:-

1. $1^\circ > 2^\circ > 3^\circ$ (in ether)
   ↳ (least molecular mass) → smaller non-polar chain.

Reactivity of Alcohols:-

Characteristic Rxns :-

1) Elimination rxns (produces alkenes)
2) SN rxns (produces substitution products)
3) Electrophilic substitution rxns

① O-H bond breaking
- acid-base rxn (shows acidic nature)
- electrophilic substitution rxn.

$$R-OH + Na \longrightarrow R-\bar{O}Na^{+} + H_2$$

② C-O bond breaking :-
- shows the basic nature
- SN rxn

$$R-\boxed{OH} + H(X)^{\ominus} \longrightarrow R-X + H_2O$$

③ C-H(β) and C-O breaking :
- β-Elimination / 1,2-Elimination (reactivity order 3° > 2° > 1°)

④ C-H(α) and O-H breaking ; α-elimination
- oxidation rxn.

Reaction in which C-O bond breaks	Rxn in which O-H bond breaks.
* If a nucleophile attacks on an R-OH, C-O bond breaks and a carbocation is formed.	* If an electrophile attacks, the O-H bond breaks & an alkoxide ion is formed

M T W T F S DATE: 132

Order of Reactivity:

3° R-OH > 2° R-OH > 1° R-OH

Rxns:

$C_2H_5OH + COCl_2 \xrightarrow{\text{Pyridine}} C_2H_5Cl + SO_2 + HCl$

$C_2H_5OH + HCl \xrightarrow{ZnCl_2} C_2H_5Cl + H_2O$ (Lucas test)

$C_2H_5OH + HNH_2 \longrightarrow C_2H_5NH_2 + H_2O$ (ethylamine)

Reactions of Alcohol :-

→ Due to O-H bond breaking :-

1. Esterification :

→ formation of Ester

→ 'H' for H_2O formation comes from ethanol (alcohol) and OH from acetic acid (carboxylic acid)

→ called as Fischer Esterification

→ a type of condensation rxn.

$CH_3-\overset{O}{\overset{\|}{C}}-OH + CH_3-O-H \xrightleftharpoons[\text{conc.}]{H_2SO_4} CH_3-\overset{O}{\overset{\|}{C}}-OCH_3 + H_2O$

(Ethanoic acid) (methyl-acetate)

Order of Reactivity:

$CH_3-OH > 1° R-OH > 2° R-OH > 3° R-OH$

Rxns

1) $2C_2H_5OH + 2Na \longrightarrow 2C_2H_5O^-Na^+ + H_2$

2) $C_2H_5OH + CH_3MgI \longrightarrow CH_4 + Mg(I)OC_2H_5$ (rxn with Grignard reagent)

3) $C_2H_5OH + CH_3COOH \xrightleftharpoons{H_2SO_4} CH_3COOC_2H_5 + H_2O$ (formation of ester)

M T W T F S DATE: 133

→ It is reversible and the position of equilibrium lies slightly to the product side when reactants are simple R-OH and COOH.

→ Order of reactivity of R-OH

→ For steric reasons, the order of reactivity is given as;

$CH_3-OH > 1° > 2° > 3°$

ii) Rxn with acid halide:

$R-\overset{O}{\overset{\|}{C}}-H + X-\overset{O}{\overset{\|}{C}}-R \longrightarrow R-O-\overset{O}{\overset{\|}{C}}-R + HX$

(ester formation)

iii) Rxn with reactive Metal:

$R-O-H + Na \longrightarrow R-O^-Na^+$ (metal alkoxide)

↳ very strong base / nucleophile

iv) Rxn with Grignard Reagent:

$R-O-H + R-Mg-X \longrightarrow R-R$ (alkane) (ALKOHOLYSIS)

v) Rxn with H_2SO_4/Δ:

$R-O-H + H_2SO_4 \longrightarrow RHSO_4$

vi) Rxn with HNO_3/Δ:

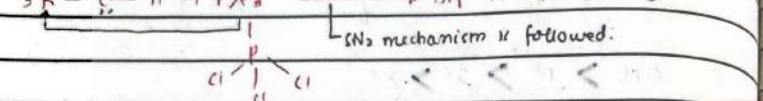
$R-O-H + HNO_3 \longrightarrow R-O-NO_2$

Inorganic Ethers

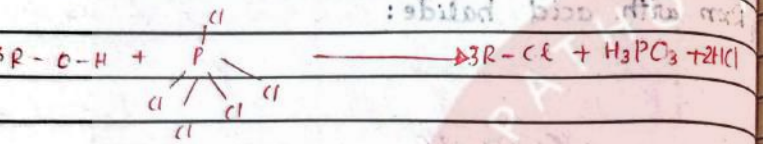
Checked By:

→ Rxn Due to C-O Bond Breaking:

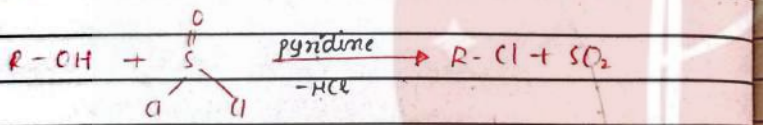
i, Rxn with PX_3: (Phosphorus trihalides)



→ Rxn with PX_5



ii, Rxn with $SOCl_2$:

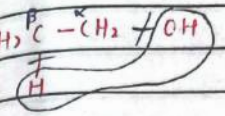


S_Ni mechanism is followed.

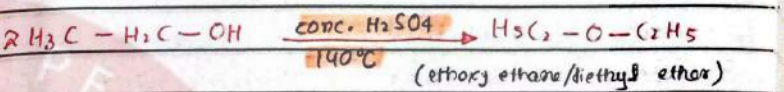
In these first 3 rxns,
R-OH act as initial nucleophile
X^- is the main nucleophile.

iii, condensation rxn / acid-catalyzed dehydration rxn:

→ Intermolecular dehydration
→ Order of rate of dehydration of R-OH
$3^\circ > 2^\circ > 1^\circ$



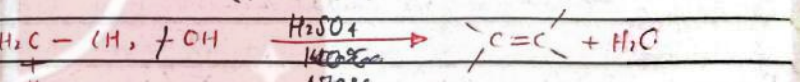
→ elimination rxn → acid-catalyzed dehydration.
→ unimolecular dehydration
→ breaking of C-O and C-H bond



→ condensation rxn → Inter-molecular dehydration
→ Bimolecular dehydration. (b/w two molecules)

(c) C-O and C-H bond breaking:- (β-1,2-elimination rxn)

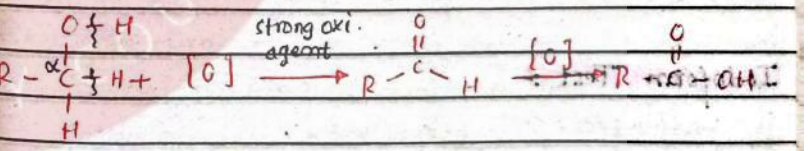
(β-hydrogen)

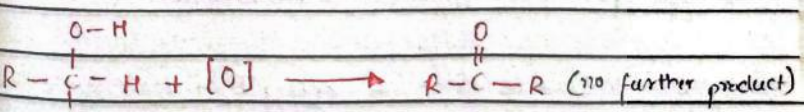


→ Intramolecular dehydration (within the molecule)

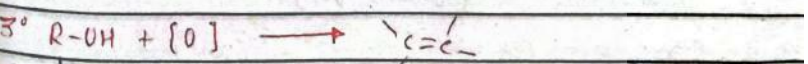
(d) O-H and C-H breaking (of same carbon):

(α-hydrogen) (oxidation rxns)





↳ partial oxidation.



↳ requires more drastic conditions.

↳ partial oxidation
↳ moderate oxidising agent.

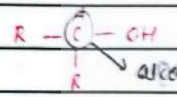
M T W T F S DATE: 136

1. Oxidation

↳ addition of O_2
↳ removal of H_2
↳ Loss of $\bar{e}$

alcohols $\xrightarrow{[O]}$ carbonyl compounds $\xrightarrow{[O]}$ COOH

1° alcohol ⟶ aldehyde
2° alcohol ⟶ ketones
3° alcohol ⟶ resistant to [O].
↳ undergo elimination and forms alkenes



alcoholic C doesn't have α (hydrogen.) →
→ no α- H, no oxidation.

Reagent :- acidified Potassium dichromate / permanganate
$K_2Cr_2O_7 / H_2SO_4$ $KMnO_4$.

Book Pg (KP) 206 + 207.

Iodoform Test :-

$CH_3-OH + I_2 + NaOH$ ⟶ no reaction

$C_2H_5-OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$

(yellow ppt.)

M T W T F S DATE: 137

Alcohols having only one (necessary min. 1) methyl group at α-carbon will show +ive iodoform test.

$I_2 + NaOH$ ⟶ sodium hypoiodide ($NaIO$)

NaIO ⟶ strong oxidizing agent
↳ carries out the oxidation of R-CH and forms acetaldehyde which converts back to CHI_3 (yellow ppt).

ESTERIFICATION :-

COOH + Alcohol $\underset{OH^-}{\overset{H^+}{\rightleftharpoons}}$ Ester + H_2O

(i) 1st OH bond breaking of R-OH.
(ii) then C-O bond breaking of COOH.
(iii) R-OH acts as a nucleophile.
(iv) catalysed by acid / base.
(v) rxn proceeds towards completion in basic media.
(vi) exist in equilibrium in acidic media.
(vii) in aqueous form ; very slow or almost no rxn.

→ Reactivity Order :-

simplest — R-OH, COOH } both give fastest rxns (least steric hindrance, more faster rxn).

→ For same R-OH and different acids ;

$HCOOH > CH_3COOH > C_2H_5COOH > C_3H_7COOH$

(bigger R ; more steric hindrance ; least reactive)

$CH_3COOH > CH_2ClCOOH > (CH_3)_2CHCOOH > (CH_3)_3COOH$

→ For same RCOOH and diff. R-OH:

$CH_3-OH > C_2H_5-OH > C_3H_7-OH > C_4H_9-OH$

CH_3-OH $1^\circ > 2^\circ > 3^\circ$

→ Acidity / Basicity of Alcohol:

$2R\bar{O}-H + 2M \longrightarrow 2R\bar{O}M^+ + 1/2\ H_2\uparrow$

Order of Reactivity of Alcohols with Reactive Metal (Cu, Zn, Na, Ca, Mg etc).

$CH_3-OH > 1^\circ > 2^\circ > 3^\circ$

CH_3-OH: strongest acid, weakest base

3°: weakest acid, strongest base (more $\bar{e}$ donating effect)

$CH_3-OH > C_2H_5-OH > C_3H_7OH > C_4H_9OH$

↳ smallest R (least $\bar{e}$-donating effect)

Acidity / Basicity of Order :

$R-\overset{R}{\underset{R}{C}}-O^{\ominus}$ (the -ive charge inc?)

Acidity : $CH_3-OH > 1^\circ > 2^\circ > 3^\circ$ → unstable → acidity ↓

Basicity : $3^\circ > 2^\circ > 1^\circ > CH_3OH$

Rxn that shows the basic nature of R-OH (C-O bond breaking) (Lucas test):-

$R-OH + H-X \longrightarrow R-OH_2 + X^{\ominus} \longrightarrow R-X + H_2O$

(base) (acid)

Acidity $\propto$ $\bar{e}$-withdrawing group

Acidity $\propto$ $\frac{1}{\text{e-donating groups } (\ddot{O}H, R, \ddot{N}H_2)}$

Basicity $\propto$ $\bar{e}$-donating groups

Basicity $\propto$ $\frac{1}{\bar{e}\text{-withdrawing groups } (CN, NO, \dots)}$

General Order of reactivity of alcohol:-

① same alcohol diff. HX;

$H-F < H-Cl < H-Br < H-I$

② same HX diff. Alcohol:

$CH_3OH < 1^\circ < 2^\circ < 3^\circ$

(strongest acid) (strongest base)

$CH_3OH < C_2H_5-OH < C_3H_7OH < C_4H_9OH$

Lucas Test:-

→ used to different alcohols.

→ Lucas Reagent:- Anhydrous $ZnCl_2$ + conc. HCl.

Checked By:_____

M T W T F S

DATE: 140

1 HI, HBr → give fast rxn
↳ no need of catalyst.

HF, HCl → slow rxn
↳ need a catalyst

1° R-OH + LR → very slow (no rxn at RTP)
↓
(weakest base)

2° R-OH + LR → Intermediate speed
(5 to 10 mins)
↓

Result :- i, oily layer formation
(formation of alkyl halide) : ii, cloudy appearance
iii, turbid appearance

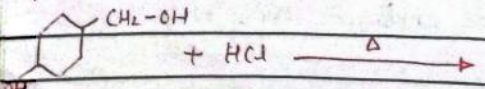
3° R-OH + LR → Fastest rxn (immediately)

Results :- i, oily appearance
ii, cloudy appearance
iii, turbidity.

MCQ :- An unknown alcohol is treated with Lucas Reagent. WOF give faster rxn and by what mechanism.

(A) 3° (SN_1) (B) 1° (SN_1) (C) 2° (SN_2)
(D) 3° (SN_2)

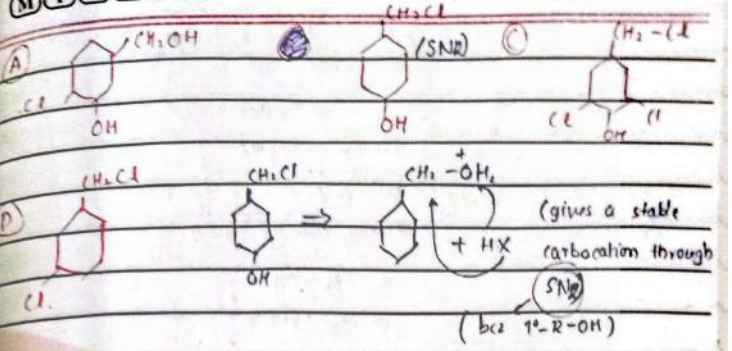
MCQ :- WOF is the main product of



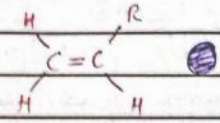
Checked By: _____

M T W T F S

DATE: 141



MCQ :- WOF give SN rxn more easily?

(A) H-C≡C-X (B)  (C) CH=CH-CH₂-X (allyl halide)

(D) All

Preparation of Alcohols:

① $H_2C=CH_2 + H_2O \xrightarrow[100°C]{conc.\ H_2SO_4,\ cold} CH_3-CH_2-OH$
(Hydration of Alkenes)

② $CH_3-I + KOH \xrightarrow[H_2O]{\Delta} CH_3-OH + KI$
(Hydrolysis of Alkyl Halides)

Alcohol

③ $R-MgX + -\overset{O}{\overset{\|}{C}}- \rightarrow -\overset{OMgX}{\overset{|}{C}}- \xrightarrow[(workup)]{H_3O^+} -\overset{OH}{\overset{|}{C}}-$ (R)

formaldehyde → 1° R-OH, and ketone → 3°
other aldehydes → 2° R-OH (Rxn of R-MgX with carbonyl compounds)

$R-MgX + R/H-\overset{O}{\overset{\|}{C}}-OR \rightarrow R/H-\overset{O}{\overset{\|}{C}}-R \xrightarrow[H_3O^+ (workup)]{R MgX}$
(ester) $-MgX(OR)$

(rxn of ester with RmgX) $R/H-\overset{OH}{\overset{|}{C}}-R$ (R)

Checked By: _____

M T W T F S DATE: 142

formate ester → 2° and higher esters → 3°

① $-\overset{O}{\overset{\|}{C}}-$ —(1. LiAlH4 or NaBH4, ether; 2. H2O)→ $-\overset{OH}{\overset{|}{C}}-H$

strong reducing agents.

② $-\overset{O}{\overset{\|}{C}}- + H_2$ —(Ni/Pt/Pd, 200°C / 10 atm)→ $-\overset{OH}{\overset{|}{C}}-H$

formaldehyde → CH_3-alcohol

Alcohols — higher aldehydes → 1° alcohol

ketones → 2° alcohol.

(Reduction of carbonyl compounds)

① $R-\overset{O}{\overset{\|}{C}}-OH$ —(1. LiAlH4, ether; 2. H2O)→ $R-\overset{OH}{\overset{|}{C}}-H$ (1° alcohol)

$NaBH_4$ (not a potent hydride donor and can't reduce COOH.)

(Reduction of COOH).

$R-\overset{O}{\overset{\|}{C}}-OR$ (acyl group of ester is cleaved) —(1. LiAlH4, ether; 2. H2O)→ $R-\overset{OH}{\overset{|}{C}}-H + R'-OH$

(Reduction of Esters)

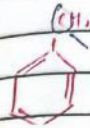
PHENOLS :-

→ hydroxy derivatives of benzene

→ the compound in which OH group is directly attached to sp^2- hybridized carbon of aromatic ring.

M T W T F S DATE: 143

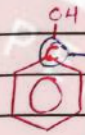
→ OH can be attached to an sp^2 hybridized carbon but still can't be phenol if that 'C' is not a part of aromatic.



(aromatic alcohol → benzyl alcohol)

$R-HC=\overset{OH}{\overset{|}{C}}-OH$ (alcohol)

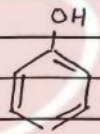
sp^2



OH — C (sp^2 hybridized)

└ part of aromatic ring.

(phenol)



1) Hydroxybenzene

2) Carbolic acid :- (the liquid phenol containing 5% of H_2O is known as carbolic acid)

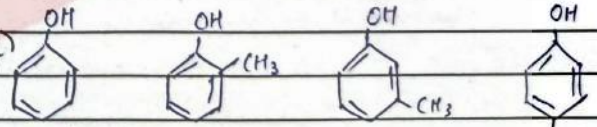
3) phene :- (old name of benzene) — used as disinfectant & germicide.

4) a compound as well as a class of OC.

Classification of Alcohols & Phenols

1. Monohydric Alcohols :-

Red (common name) Black (IUPAC)



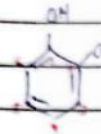
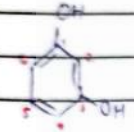
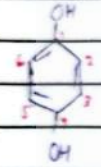
phenol — o-cresol — m-cresol — p-cresol

phenol — 2-methylphenol — 3-methyl-phenol — 4-methyl-phenol.

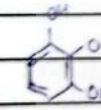
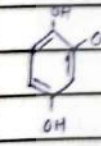
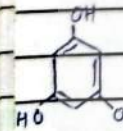
M T W T F S

DATE: 144

2. Dihydric Alcohols Phenols

Phenol	IUPAC NAME	COMMON NAME
	1,2-Dihydroxybenzene (Ex2 benzene-1,2-diol)	catechol
	1,3-Dihydroxybenzene (benzene-1,3-diol)	Resorcinol
	1,4-Dihydroxybenzene (benzene-1,4-diol)	Quinol (Hydroquinone)

3. Trihydric Phenols:

Phenol	IUPAC Name	Common Name
	1,2,3-Trihydroxybenzene	Pyrogallol
	1,2,4-Trihydroxybenzene	Hydroxyquinol
	1,3,5-Trihydroxybenzene	Phloroglucinol

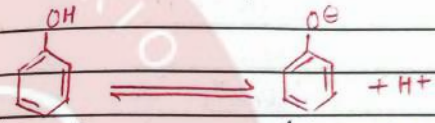
M T W T F S

DATE: 145

Physical Properties:-

1) colourless liq / low MP solid at RTP.
2) characteristic phenolic odour.
3) MP = 41°C and BP = 182°C.
4) sparingly soluble in H_2O at RTP i.e 25°C and completely soluble in H_2O at 68.5°C (forms pink skin)
5) poisonous and used as disinfectant in hospitals & washrooms.

Acidic Nature of Phenol:-



(phenol) ⇌ (phenoxide ion) + H^+ — stable due to resonance.

Carboxylic Acids > Phenol > Water > Alcohols

K_a	1.75×10^{-5}	1.3×10^{-10}	1.8×10^{-16}	$10^{(-16 \text{ to } -18)}$
pK_a	(5)	(10)	$(16)^{(-16+)}$	(16 – 18)

$R-O-H \rightleftharpoons R-O^{\ominus} + H^+$

(alcohol) ⇌ (alkoxide ion) — H^+ forcefully, so unstable

$R-\overset{O}{\overset{\|}{C}}-O-H \rightleftharpoons R-\overset{O}{\overset{\|}{C}}-O^{\ominus} + H^+$

resonates b/w the two oxygen.

carboxylate ion > phenoxide ion > alkoxide ion

↓

more stable so its chances of formation inc↑ which in turn inc↑ H^+ formation and hence acidity inc↑.

M T W T F S

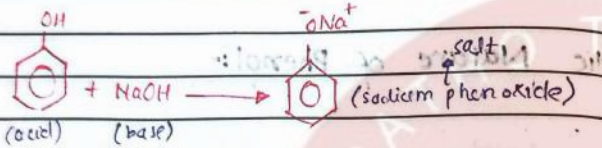
DATE: 146

$K_a \propto$ acidic strength

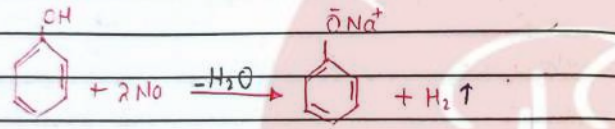
$$K_a \propto \frac{1}{pK_a}$$

PHENOLS :-

↳ dissolves in alkalies



↳



rxn with base → forms salt
rxn with metal → forms / H_2 gas is released
} shows the acidic nature.

Acidic Strength of Phenol :-

i) no effect on litmus paper
ii) doesn't evolve CO_2 from CO_3^{-2} and HCO_3^{-1}
iii) pH of its soln is 5 or 6.

Effect of Substituents On the Acidity of Phenols :

ē - withdrawing groups : (- X, NO_2, $-SO_3H$, -CN etc)

i) tends to disperse -ive charge on phenoxide ion.

M T W T F S

DATE: 147

ii) stabilize the phenoxide ion.
iii) increases the acidity. eg nitrophenol is more acidic than phenol.

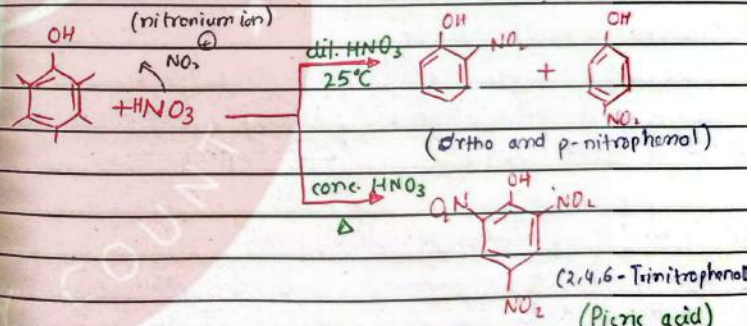
ē - donating groups ($-NH_2$, $-OR$, $-R$ etc)

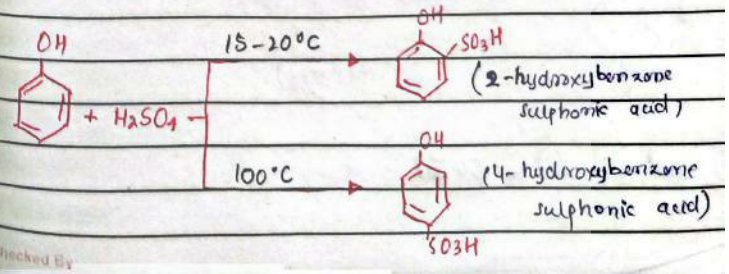
i) tends to intensify the -ive charge on phenoxide ion.
ii) destabilize the phenoxide ion.
iii) decl the acidity. e.g methyl phenol is less acidic than phenol

Para substituted phenol is more acidic than ortho phenol. (bcz of the intramolecular H-bonding)

Reactions of Phenol :-

ES Rxns (in which the benzene ring is involved).

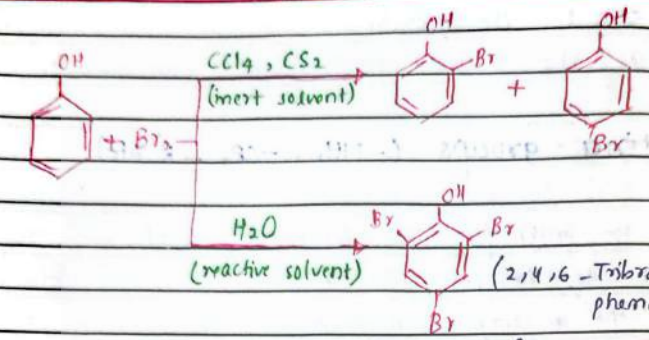




Checked By

M T W T F S

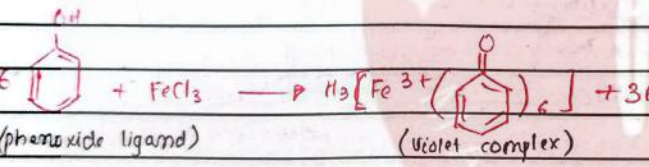
DATE: 148



Identification of Phenol :-

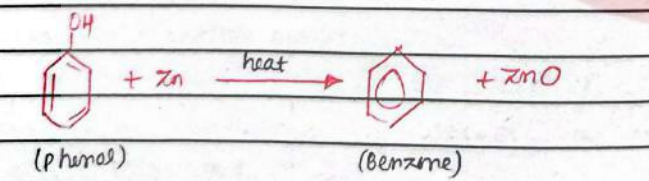
(a) Phenol + Br_2 $\xrightarrow{H_2O}$ 2,4,6-tribromophenol (white ppt)

(b) Rxn with $FeCl_3$



(c) Reduction of Phenol

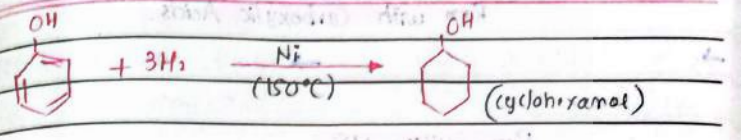
(i) with Zn dust.



(ii) with H_2 (Ni, 150°C)

M T W T F S

DATE: 149



Differentiating Alcohols And Phenols :

Alcohols	Phenols
→ Hydroxy derivative of alkanes	→ Hydroxy derivatives of benzene
→ Lowers alcohols are generally colourless liquids.	→ Colourless crystalline deliquescent solids
→ Less acidic (pK_a = 16-20)	→ More acidic (pK_a = 10)
→ Characteristic sweet smell.	→ Characteristic phenolic smell.
Br_2 - Water Test	
→ No rxn with Br_2-H_2O.	→ Give white ppt. with Br_2-water.
Rxn With NaOH	
→ No rxn with NaOH. (bcz it a weak acid)	→ React with NaOH to form salt.
Solubility in H_2O	
→ Readily soluble in H_2O	→ Sparingly soluble in H_2O at R.T.
Rxn with $FeCl_3$	
→ No rxn	→ give purple ppt.

M T W T F S DATE: 150

Rxn with Carboxylic Acids

→ gives esters with fruity smell.

→ can't react bcz both are acids.

Rxn with HX

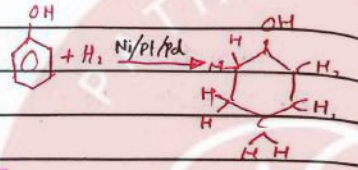
→ Lucas test

→ can't react

Metal Catalytic Reduction

→ can't undergo catalytic reduction bcz they are already in reduced state.

→ forms cycloheramol. can undergo catalytic hydrogenation.



Diazonium salt

→ no rxn

→ gives dyes

Rxn with a Reactive Metal

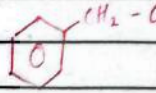
(Na, K, Mg etc.)

→ can react.

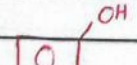
→ can react

alcohols

- Aromatic
- Aliphatic (R-OH)
  - cyclic
  - non-cyclic



→ OH not directly attached to aromatic ring.



C-C-C-OH (alkanol)

M T W T F S DATE: 151

ETHERS

→ derivatives of H_2O (dialkyl) / alkoxy derivatives of alkanes

→ Lewis base

→ Reactivity :-

- very unstable towards — i, Dilute acid
  - ii, very strong conjugate base
  - iii, strong reducing agent
  - iv, strong oxidizing agent
- only reactive towards
  - hot and conc. strong acids
  - oxonium ions.

Preparation :

- Intermolecular dehydration of alcohols (H_2SO_4 / 140°C)
- Williamson Synthesis.

① $R-OH + Na \longrightarrow R-O^-Na^+ + 1/2\ H_2$ (sodium alkoxide)

② $R-O^-Na^+ + R-X \longrightarrow R-O-R + NaX$ (ether)