

AIIMS-NORCET

Nursing Officer Recruitment Common Eligibility Test

ALL INDIA INSTITUTE OF MEDICAL SCIENCE

Volume – II (Part – 2)

PHARMACUETICAL CHEMISTRY

Organic and Inorganic Chemistry



CONTENT

	ORGANIC & INORGANIC CHEMISTRY	
1.	Important Name Reaction	1-16
2.	Drug Their Ring System	17-22
3.	General Organic Chemistry	23-25
4.	Acid Base	26-27
5.	Radiopharmaceuticals	27–29
6.	Limit Test	29-31
7.	Dental Product	31
8.	Solution	32–68
9.	Chemical kinetics	69-112
10.	Electrochemistry	113-157
11.	Ionic Equilibrium	158-211



ORGANIC CHGEMISTRY

Important Name: (Reaction)

1. Aldol Condesation: (Aldol Reaction)

* Aldehyde (R — C — H)/Keton (R — C — R) have α -H. In the present of strong base (NaOH/KOH) or strong acid (HCl) from, β -Hydroxy aldehyde.

$$CH_{3}-CH_{2}-CHO$$

$$CH_{3}-CH_{2}-CHO + \rightarrow CH_{3}-CH_{2}-CH-CH-CHO$$

$$CH_{3}-CH_{2}-CH-CHO \rightarrow CH_{3}-CH_{2}-CH-CHO$$

$$CH_{3}-CH_{2}-CH_{2}-CH-CHO$$

$$CH_{3}-CH_{2}-CH-CHO$$

$$CH_{3}-CH_{2}-CH-CHO$$

α-methyl β-hydroxy pentanal

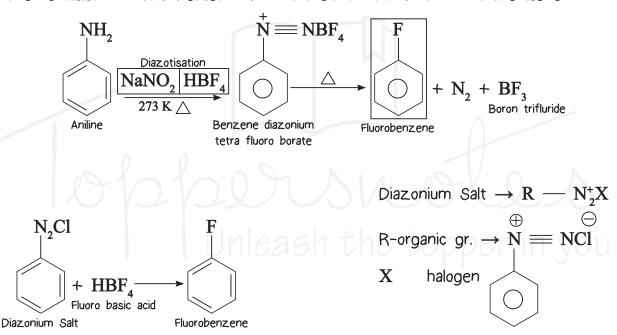
Cross aldol Reaction →

जब α-H present बही हो।



2. Belz-Schiemann Reaction:

* When Diazzonium salt treated with Fluoro Boric Acid it form fluorobenzene.



Mechanism:

$$\begin{array}{c|c} & N_2BF_4 \\ \hline & + HBF_4 - HCI \end{array} \begin{array}{c} Precipitate \\ \hline \\ Fluoro benzene \end{array}$$



3. Cannizzaro Reaction:

* When an aldehyde without any $(\alpha - H)$ undergoes Redox Reaction presence of strong base. It give alcohol & acidic salt.

In the presence 2 Aldehyd without
$$(\alpha - H)$$
 of Strong Base (KOH) Alcohol + Acidic Salt

Mechanism:

Step
$$I$$
 KOH \longrightarrow K⁺ + OH⁻

Step II: Attack of nucleophile

$$H - C - H + OH \longrightarrow H - C - H + C$$

$$O OH$$

$$O OH$$

$$H - C + C \longrightarrow H - C + H$$

$$O H$$

Trick:

SOA → Smaller Oxidized Acid

Bra → Bigger Reduced Alcohol



Clemmensen Reaction:

Carbonyl compound reduced into the alkane in the pressure of Acido Zino Amulgum [Zn(Hg)].

$$R \stackrel{O}{=} R \xrightarrow{R} R - CH_{3}$$

Mechanism:

<u>Diels-Alder Reaction:</u>

Cyclo-addition (4 + 2 addition) Dien & Alkene (Dienophile) React to form cyclic compound.

Diel-Alder is a favourable synthetic method for unstaturated six membered ring.

Mechanism:



Toppersuotes
Unleash the topper in you

Mechanism:

6. Etard Reaction:



$$\begin{array}{c|c} CH_3 & \hline \text{Tall crow called Benzeldehyde} & CHO \\ \hline \\ + & CrO_2Cl_2 & \hline \\ \\ \text{Toluene} & \text{Bendaldehyde} \\ \end{array}$$

Mechanism:

$$\begin{array}{c} \text{CH}_{3} \\ \text{Toluene} \end{array} + 2\text{CrO}_{2}\text{Cl}_{2} \\ \text{CHO} \\ \\ \text{CHO} \\ \\ \text{Benzaldehyde} \end{array}$$

7. Friedel Craft Alkylation:

* It is electrophilic substitution Reaction Alkydation of aromatic compound in the presence of Lewis Acid (FeCl₂) as a catalysis.



Mechanism:

$$R - \stackrel{Cl}{X + Al} - Cl \longrightarrow R - X - \stackrel{Cl}{Al} - Cl \longrightarrow R + \stackrel{\bigoplus}{AlCl_2} X^{\oplus}$$

Example:

$$+ C_2H_5C1 \xrightarrow{\text{AlCl}_3} + \text{HCl}$$

8. Friedel Craft's Acylation:

- * It is electrophilic substitution reaction.
- * Acylation of aromatic compound & prouduce aromatic ketone via reaction between benzene & acyl chloride or anhydride.
- * Acylation: Adding of Acyl groud (R C = O)

$$C - R$$

$$X \xrightarrow{AlCl} R$$

$$AlCl_3 + HX$$

$$Alcl_3 + HX$$

1.
$$\bigcirc$$
 + CH₃COCl \longrightarrow AlCl₃ + HCl Benzene Acetyl Chloride Phenyl Ethanone



2.
$$\bigcirc$$
 + CH_3CH_2COC1 \longrightarrow \bigcirc + $HC1$

Phenyl Propanone

9. Finkelstein Reaction:

* When Alkyl Halide (C $\stackrel{}{-}$ C $\stackrel{}{-}$ Br) react with Sodium Iodide (NaI) in the presence of Acetone (CH $_3$ $\stackrel{}{-}$ C $\stackrel{}{-}$ CH $_3$) or methanol (CH $_3$ $\stackrel{}{-}$ OH) it form Alkyl Iodide.

Example:

$$CH_3$$
 — CH_2 — $Br + NaI$ — $Acetone/$ — CH_3 — CH_2 — $I + NaBr$

10. Gattermann Reaction: leash the t

* Diazonium salt is treated with $H\!X$ with $C\!u$ to form Haloarene ()

$$\begin{array}{c|c}
N_2^+\text{Cl}^- & X \\
\hline
 & \\
& \\
\end{array}$$

$$+ \text{ HX} \qquad Cu \qquad + \text{ N}_2(\uparrow)$$

$$N_2^+Cl^ + HCl$$
 Cu
 $+ N_2(\uparrow)$

Benzene diazonium chloride

Chlorobenzene



11. Kolbe's Schmitt Reaction:

* When phenol (C_6H_5OH) is treated with NaOH & reacted with CO_2 at $400^{\circ}K/125^{\circ}C$ & 6 atm pressure followed by Acidification \rightarrow Salicylic acid will be form [In the presence of Base(NaOH)]

12. Lucas Test:

* It is used to distinguish (different) between primary, secondary & tertiary aliphatic alcohol.

Lucas Reagent: Anhydrous zinc chloride in conc. HCl

$$ZnCl_3 + HCl$$

$$R - OH + HCl \xrightarrow{ZnCl_2} RCl + H_2O$$

* When present tert alcohol $\rightarrow Rx^n$ immediately (Turbid)

Sec. alcohol → Turbid in 6-7 min

Primary alcohol → take more time to form turbid.

13. Riemer Tiemann Reaction:

* When phenol react with chloroform (CHCl₃) in the presence of NaOH then — CHO (aldehyde) group introduce at ortho (O) position & form salicyaldehyde.



14. Rosen Munal Reduction Reaction:

* Hydrogenation of Acyl Chloride into aldehyde catyalysed by Lindlar Regent $(H_2 + Pd - BaSO_4)$

Example:

1.
$$CH_3 - C - Cl + H_2 \xrightarrow{Pd, BaSO_4} CH_3 - C - H + HCl$$

2. $C_6H_5 - C - Cl + H_2 \xrightarrow{Pd, BaSO_4} C_6H_5 - C - H + HCl$

$$R - C - Cl + H_2 \xrightarrow{Pd-BaSO_4} R - C - H$$

Acid Chloride

15. Sand-Meyer's Reaction:

* Diazzonium salt is treated with Hx/CuX to form Halo Arene.

$$N \equiv N^{+}Cl^{-}$$

$$+ HX \xrightarrow{CuX} + N_{2} \uparrow$$
Diazzonium Salt
$$+ HAlo Arene$$

$$\begin{array}{c|c} NH_2 & N \equiv N^+C1^- \\ \hline & NaNO_2 \\ \hline & 2HCl \\ -NaC1 \\ -2H_2O & Diazonium Salt \\ \end{array}$$



$$N_2^+Cl^ + HCl$$
 $CuCl$
 $+ N_2 1$

16. Swarts Reaction:

- * Halide exchange reaction (N2)
- * When alkyl halide react with transition metal fluoride compound it form Alkyl fluoride.

$$R \xrightarrow{\quad X \quad \frac{Agf_{4'} \ Sb_3F_2}{Hg_2F_2}} R \xrightarrow{\quad F \quad F \quad Ag \quad X \ (\text{PPt})}$$
 Alkyl Fluoride

Isomerism will be change in swart reaction e.g. $R \rightarrow S$, $S \rightarrow R$

Example:

$$CH_3$$
 — $CH_2Cl + AgF$ — $CH_3CH_2F + AgCl (ppt)$

17. Stephen Reaction:

* This Rxⁿ involve the preparation of Aldehyde [R - C - H] from Nitrites [R - CN] using tin [II] Chloride $[SnCl_2]$, Hydrochloric acid [HCl] & quenching (cooling) the resulting immium salt $[(RCH - NH_2) + Cl^-]$ with water (H_2O) .

Reaction:

$$R \longrightarrow CN + 2[H] \xrightarrow{SnCl_2/dil. HCl} R \longrightarrow CH \longrightarrow NH \cdot HCl \xrightarrow{Boiling H_2O} RCHO + NH_4Cl$$
Alkyl cyanide [Immine Hydrochloride] (Salt)

7.
$$CH_3 - C \equiv N + 2[H] \xrightarrow{SnCl_2/dil. HCl} CH_3 - CH = NH \cdot HCl$$
 NH_4Cl
 $Acetaldehyde$
 $CH_3 - CH = NH \cdot HCl$
 $Acetaldehyde$
 $CH_3 - CHO$
 $Acetaldehyde$
 $Acetaldehyde$
 $CH_3 - CHO$
 $Acetaldehyde$
 $Acetaldehyde$
 $CH_3 - CHO$
 $Acetaldehyde$
 $Acetaldehyde$

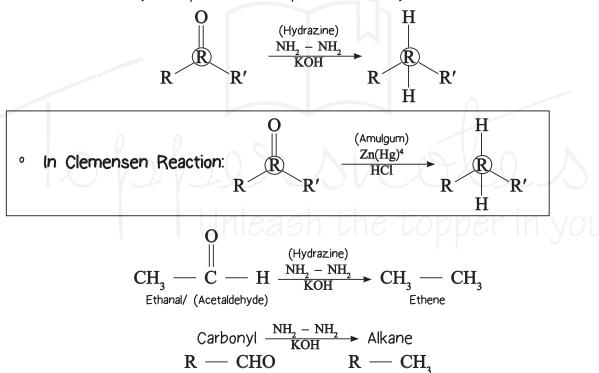


18. <u>Victor Meyers Test:</u>

- * This test is used to distinguish between 1°, 2°, 3° alcohol (reagent used $P+I_2$, $AgNO_2$, HNO_2 , NaOH)
 - 1° alcohol \rightarrow Red colour (Blood Red Colour)
 - 2° alcohol → Blue colour
 - 3° alcohol \rightarrow It does not give victor mayer test.

19. Wolf Kishner Reaction:

* Reduction of carbonyl compound in the presence of Hydrazine/KOH to alkene.



20. Wurtz-Fitting Reaction:

* When aryl halide & alkyl halide react with sodium in the present of dry ether alkyl arene compound formed.

$$X$$

$$+ 2Na + R - X \xrightarrow{Dry \text{ ether}} R$$
Aryl Halide

Alkyl halide

Alkyl Arene



Example:

21. Wurtz Reaction:

* When alky halide (Haloalkane) react with metalic Na+ (sodium) in the presence of dry ether it will form alkane.

$$R - X + 2Na + R - X$$
 Dry ether $R - R + 2NaX$

Example:

(Carbon no. will be double \rightarrow (4))

22. Mendius Reduction Reaction:

- * In mendius reaction nitriles on reduction with Na in ethanol give primary amines.
- * The reaction is used for prepⁿ of amines containing one carbon atom more than the starting amine.

$$R - C \equiv N + 4(H) \xrightarrow{Na/Ethanal} R - CH_2 - NH_2$$
Alkyl cyanide

1.
$$CH_3 - C \equiv N + 4(H) \xrightarrow{Na/Ethanal} CH_3 - CH_2 - NH_2$$
Acetonitrile (Ethane nitrile) Ethyl amine (Ethan amine)

2.
$$CH_2 - C \equiv N + 4[H] \xrightarrow{Na/E thanal}$$

Phenyl acetonikile

 $CH_2 - CH_2 - NH_2$
 β -phenyl ethyl amine



23. Gabriel Phthalamide Reaction:

* Used for prepⁿ of aliphatic primary amine.

24. Azo Coupling:

* Diazo means two nitrogen (- N = N)

Prepn of diazonium salt:

$$NH_2$$
 $N^+ \equiv N^+ - C1$
 $N^+ \equiv N^+ - C1$

Coupling reaction with Phenol (Electron Riched Aromatic Compound)

$$N^+ \equiv N^+ Cl^- + Cl^- + Cl^- + Cl^-$$
Benzene diazanium Chloride

 $N = N + Cl^- + Cl^-$
Diazo product

 $N = N + Cl^-$
OH

Coupling reaction with aniline:

$$\begin{array}{c} N^+ \equiv N - Cl^- & H \\ + & \\ \\ Benzene \ diazonium \ chloride & \\ \\ NH_2 & \\ \\ \\ N = N \\ \\ \\ Diazo \ product & \\ \\ NH_2 & \\ \\ \\ \\ \end{array} + \ HC1$$



- * Substitution occur at P-position (Ele-rich a.c.)* Used in productin of dye & pigment

SN¹		SN ²	
٦.	Unimolecular Nucleophitic reaction	٦.	Bimolecular nucleophilic reaction
2.	Rate = $K[R - \alpha]^1$	2.	Rate = $K[R - X]^1[N_4]^1$
3.	Molecularity = Order = 1	3.	Molecularity = order = 2
4.	2-step reaction	4.	Single Step = reaction
5.	Nu [⊖] weak (Rate of reaction)	5.	$ m Nu^{\odot}$ strong
6.	Order of $\mbox{\bf R}\mbox{\bf x}^{\mbox{\tiny n}}$ with substrate $(R$ — $X)$	6.	Order of ROR with respect of
	$3^{\circ} > 2^{\circ} > 1^{\circ} > CH_3 - X$		substract $CH_3 - X > 1^{\circ} > 2^{\circ} > 3^{\circ}$
	ROR ∞ Stability of carbocation		ROR ∝ 1 Steric hindrance
7.	Solvent \rightarrow polar protic (Heb, CH $_3$ COOH)	7.	Polar aprotic solvent (Acetene)
			СН ₃ — С — СН ₃
8.	Order of rate of reaction (leaving	8.	Order of rate of reaction
	group) Halogen		$R \longrightarrow R \longrightarrow Br > R \longrightarrow C1 > R$
	R - I > R - Ir > R - Cl >		R - F
	R - F	+	he topper in vou
q.	If substract is optically active then → Recemic mixture is form	٩.	If substract is optically active
	Necetilic triix(dre is form		then \rightarrow Inversion form is formed (Walder form)
	H		(Walder 1811)
	$R \longrightarrow \dot{C} \longrightarrow N_4 \mid N_4 \longrightarrow \dot{C} \longrightarrow R$		
	$ \begin{array}{c c} H \\ R' \end{array} $ $ \begin{array}{c c} H \\ N_4 \\ \end{array} $ $ \begin{array}{c c} H \\ R' $		
10.		10.	H
	E. E.		$N_2 = C = X$
			R = C = A
	R Two step reaction P		P
			Intermediate ${}^{igstyle -} P$

Organic Chemistry

1. SN¹ Step-1:

$$R - CH_2 - Cl \xrightarrow{\qquad \qquad } R - CH_2^{\oplus} + O \xrightarrow{\qquad \qquad } H$$
Slow

Step 2:

$$R \ -\!\!\!\!- \ CH_2^+ + OH^{\scriptsize \bigcirc} \longrightarrow R \ -\!\!\!\!\!- \ CH_2 \ -\!\!\!\!\!- OH$$

2. SN2

$$R - C = Cl + OH \longrightarrow HO \xrightarrow{R} C - Cl \\ H$$
Intermediate [Unstable]
$$HO - C \xrightarrow{R} H$$

Order:

$$3^{\circ} > 2^{\circ} > 1^{\circ}$$

Reactivity Order:

्र R क्योंकि $C \longrightarrow R$ R group **उ**यादा है तो OH easily attack **ग**ही कर पाएगा। R

Elemination Reaction:

E,		E,		
1.	Unimolecular Eliminatin Reaction	1.	Bimolecular Elimination Reaction	
2.	2 Step Reaction	2.	Single Step Reaction	
3.	Rate = $K[R - x]^1$ (Substrate)	3.	Rate = $K[R - X][OH]$ Base	
4.	Order = Molecularity = 1	4.	Order = Molecularity = 2	
5.	Weak Base + Δ	5.	Strong Base	
6.	$C_2H_5OH + \Delta$, E + OH + Δ	6.	Alcoholic KOH, NaNH2, C2H5O9/alcohol	
7.	Carbocation form	7.	No Carbocation form	
8.	Rearrangement Possible	8.	Rearrangement not possible	