CHAPTER 12

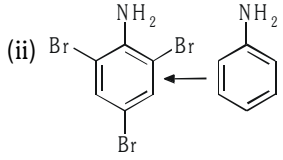
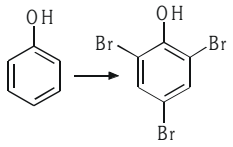
Nutshell review & preview of
ORGANIC REAGENTS

1. *Alcoholic KOH*
R—X → Alkene ; Elimination

2. *Aluminium Ethoxide*
$RCH{=}O \longrightarrow R{-}\underset{\underset{O}{\|}}{C}{-}O{-}CH_2R$ (Tischenko Reaction)
(Aldehyde) (Ester)

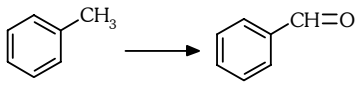
3. *Aqueous KOH/NaOH*
R—X → ROH
Nucleophilic substitution reaction also used for Cannizzaro reaction with aldehyde.

4. *Baeyer's Reagent* (Alkaline cold dilute $KMnO_4$)
$RCH{=}CHR' \longrightarrow \underset{\underset{OH}{|}}{RCH}{-}\underset{\underset{OH}{|}}{CHR'}$ (Syn)
alkene ⟶ 1, 2 diol
(used to detect unsaturation)

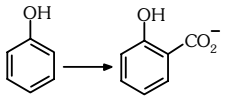
5. *Bromine water*
(i) used to detect unsaturation;
(ii) 
2,4,6-tribromoaniline
(iii) 
2,4,6-tribromophenol

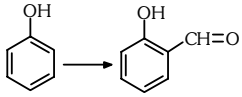
6. *Benedict's solution*
Used to detect aldehyde group RCHO → RCO_2^-
[ketone gives -ve test]

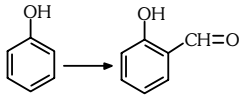
7. *Cu_2Cl_2 + NH_4OH*
Used to Detect Terminal Alkyne
Red Precipitate observed

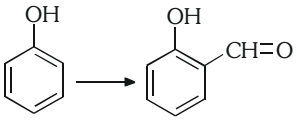
8. *CrO_2Cl_2*

Etard reaction

9. *CrO_3*
(i) $RCH_2OH \rightarrow RCHO$,
(ii) $R_2CHOH \rightarrow R_2C{=}O$
(iii) R_3COH → no reaction

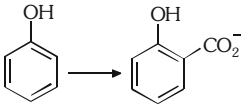
10. *CCl_4 + OH^-* (Reimer Tiemann)
 + p-Product

11. *CO + HCl + $AlCl_3$*
 + p-Product
Gatterman koch reaction

12. *HCN + HCl + $AlCl_3$* 
Gatterman Aldehyde Synthesis

13. *$CHCl_3$ + KOH*
(i) 
Reimer Tiemann reaction

(ii) $RNH_2 \rightarrow RNC$ ***(Carbyl amine reaction)***
(used to detect 1° Amine) (Isocyanide test)

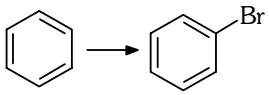
14. *CO_2 + OH^- (high temp. + Pressure)*
 + p–Product
Kolbe's reaction

15. *Cu/Δ*
(i) $RCH_2OH \rightarrow RCHO$,
(ii) $R_2CHOH \rightarrow R_2C{=}O$
(iii) $H_3C{-}\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}{-}OH \longrightarrow H_2C{=}C\begin{matrix}CH_3\\CH_3\end{matrix}$

16. *2,4 – D.N.P.*
used to detect carbonyl group (orange ppt observed)

17. *DMSO*
Polar aprotic solvent: favour S_N2 mechanism

18. *Fe+ Br_2/$FeBr_3$*



19. *Fehling solution*

used to identify – CH=O group.
PhCHO gives –ve test
Observation: red ppt of Cu_2O formed

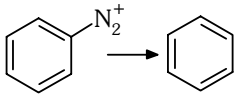
20. *Grignard Reagent*

Follows (i) Acid base reaction (ii) NAR (iii) NSR

21. *H_2(Pd/$CaCO_3$) Quinoline (Lindlar catalyst)*

R—C≡C—R→ R—CH=CH—R (cis)

22. *H_3PO_2*



23. *HN_3 + H_2SO_4*

$$R-\underset{\underset{O}{\|}}{C}-OH \longrightarrow RNH_2$$

(Schmidt Reaction)

24. *H_3PO_4/Δ*

H_3PO_4 ⇒ Same as H_2SO_4/Δ

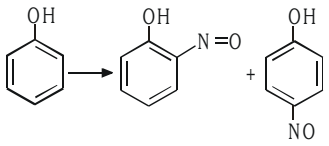
25. *H_2SO_4/Δ*

$$\underset{\underset{OH}{|}}{RCH}-CH_3 \longrightarrow RCH=CH_2$$

Saytzeff product; C^+ mechanism;
Rearranged alkene can be formed

26. *HNO_2 ($NaNO_2$ + HCl)*

(i) $RNH_2 \rightarrow R—OH$;
(ii) $PhNH_2 \rightarrow PhN_2^+$ (0 – 5°C)
(iii) $PhNH_2 \rightarrow PhOH$ (high temperature)

(iv) 

27. *HIO_4 (Periodic acid)*

$$RCH(OH)-CH(OH)-R' \longrightarrow RCH=O + R'CH=O$$

Oxidative cleavage of diol

28. *H_2(Ni) can reduce*

(i) $R-\underset{\underset{O}{\|}}{C}-R \longrightarrow R_2CHOH$

(ii) $R-\underset{\underset{O}{\|}}{C}-H \longrightarrow RCH_2OH$

(iii) $RCN \rightarrow RCH_2NH_2$; $-C\equiv C- \rightarrow -CH_2-CH_2-$,
$-HC=CH- \rightarrow -CH_2—CH_2-$

29. $H_2(Pd/BaSO_4)$
Quinoline

$$R-\underset{\underset{O}{\|}}{C}-Cl \longrightarrow RCH=O$$

(Rosenmund reduction)

30. *Jones Reagent (CrO_3 + dil. H_2SO_4+ acetone)*

(i) $RCH_2OH \rightarrow RCH=O$; (ii) $R_2CHOH \rightarrow R_2C=O$

31. *$KHSO_4$* Dehydrating Reagent

$$\underset{\underset{OH}{|}}{CH_2}-\underset{\underset{OH}{|}}{CH}-CH_2-OH \longrightarrow CH_2=CH-CH=O$$

32. *$K_2Cr_2O_7/H^+$*

(i) $RCH_2OH \rightarrow RCO_2H$; (ii) $R_2CHOH \rightarrow R_2C = O$

33. *MnO_2*

(i) $CH_3—CH=CH—CH_2—OH \rightarrow CH_3—CH=CH—CH=O$
(ii) $PhCH_2OH \rightarrow PhCH=O$
To oxidise allylic / benzylic hydroxyl group into corresponding carbonyl.

34. *$NaHCO_3$*

$$RCO_2H \xrightarrow{NaH\overset{14}{C}O_3} RCO_2^-Na^+ + \overset{14}{C}O_2 \uparrow$$

35. *$NaHSO_3$*

$$R-\underset{\underset{O}{\|}}{C}-R \rightarrow RC(OH)(SO_3^-Na^+)$$

[White crystals, soluble in water used to separate carbonyl from noncarbonyl compound]

36. *NaOH(aq)*

(i) R—X → R—OH

(ii) $R-\underset{\underset{O}{\|}}{C}-OR' \xrightarrow[(H_2O)]{NaOH} R-\underset{\underset{O}{\|}}{C}-O^- + R'OH$

Basic hydrolysis of ester

(iii) $HCHO \xrightarrow{OH^-} HCO_2^- + CH_3OH$ (cannizaro)

(iv) $H_3C-CH=O \xrightarrow[\Delta]{OH^-} H_3C-CH=CH-CH=O$
(Aldol condensation)

37. Ninhydrin

Detection of amino acid

Observation : Purple coloured ion

38. NaOR

Strong base :

(i) $RCH(X)-CH_2-R \longrightarrow RCH=CH-R$

(Saytzeff Product : E_2 elimination)

(ii) $H_3C-C(=O)-OEt \longrightarrow H_3C-C(=O)-CH_2-C(=O)-OEt$

(claisen condensation) (β keto ester)

39. NaOH + X_2 or NaOX

(i) $RC(=O)-CH_3 \xrightarrow{-CHI_3} RCO_2^-$ (Haloform reaction)

(ii) $R-C(=O)-NH_2 \longrightarrow RNH_2$ (Hoffman Degradation)

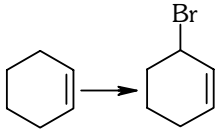
40. NaOH + CaO

$RCO_2H \rightarrow RH$

41. MnO / 300°C

used for $-CO_2$ & $-H_2O$ in carboxylic acid.

42. NBS

(i)  ; (ii) $PhCH_3 \rightarrow PhCH_2—Br$

43. $NaNO_2$ + HCl

$RNH_2 \rightarrow R—OH$

44. $NaNH_2$ in paraffin

Non-terminal Alkyne →Terminal Alkyne

(2–Butyne → 1–butyne)

45. Na/EtOH

Reduce all except c/c double & triple bond

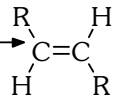
46. Zn(Hg) + HCl [Clemmensen's reduction]

$R-C(=O)-R \longrightarrow R-CH_2-R$

47. NH_2 ***–NH_2/OH^-*** [Wolf Kishner reduction]

$R–CO–R \rightarrow R–CH_2–R$

48. Na in Liq. NH_3 [Birch reduction]

$R-C\equiv CR \longrightarrow$ 

(trans alkene)

49. OsO_4 + H_2O

$RCH=CHR \longrightarrow RCH(OH)-CH(OH)-R$

(syn addition)

50. O_3 $: R-CH=CH-R \xrightarrow[H_2O\backslash Zn]{O_3} R-CHO + R-CHO$ (Ozonolysis process)

51. Oxirane followed by H^+

$RMgX \rightarrow RCH_2—CH_2—OH$

52. PCC

(i) $RCH_2OH \rightarrow RCHO$,

(ii) $R_2CHOH \rightarrow R_2C=O$

(iii) $R_3COH \rightarrow$ no reaction

(Mild oxidizing reagent)

53. P(red) + Br_2

(i) $CH_3CO_2H \rightarrow H_2C(Br)-CO_2H$ (HVZ reaction)

(ii) $ROH \rightarrow R—Br$

54. P (red) + HI

$CH_3CO_2H \rightarrow CH_3—CH_3$

$CH_3CH=O \rightarrow CH_3—CH_3$

$CH_3CH_2OH \rightarrow CH_3—CH_3$

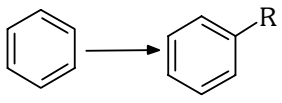
(strong reducing agent can reduce any oxygen or halogen containing compound to alkane)

55. Perbenzoic acid [Baeyer Villiger Oxidation]

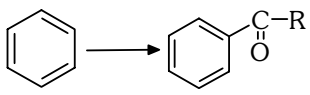
$R-C(=O)-R' \longrightarrow R-C(=O)-OR'$

R' having more migrating tendency than R

56. RCl+$AlCl_3$ [Friedel craft alkylation]



57. RCOCl + $AlCl_3$ [Friedel craft acylation]

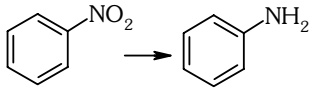


58. $ROH + R-\overset{\overset{O}{\|}}{C}-OH \xrightarrow[H_2SO_4]{conc.} R-\overset{\overset{O}{\|}}{C}-OR$

Ester formed (Esterification reaction)

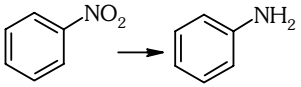
59. $SnCl_2$ + HCl

(i) $R-N=N-R' \rightarrow RNH_2 + R'NH_2$

(ii) 

(iii) $RCN \rightarrow RCH=O$ [Stephen reduction]

60. Sn + HCl

(i) 

(ii) $RCN \rightarrow R\text{–}CH_2NH_2$

61. Silver salt RCOOAg (Hunsdiecker reaction)

$Br_2/CCl_4/\Delta \rightarrow RBr + CO_2 + AgBr$

62. AgOH/moist Ag_2O; $R_4\overset{+}{N}\bar{X} \rightarrow R_4\overset{+}{N}\bar{O}H$

63. $SOCl_2$

$R-\overset{\overset{O}{\|}}{C}-OH/R-OH \longrightarrow R-\overset{\overset{O}{\|}}{C}-Cl/R-Cl$

64. Tollens Reagent Test

(i) Terminal alkyne gives
(ii) Aldehyde Group gives
(iii) Ketone gives –ve test
(iv) α-hydroxy ketone gives
(v) HCOOH gives
(vi) Hemi acetal gives
(vii) PhNH–OH gives

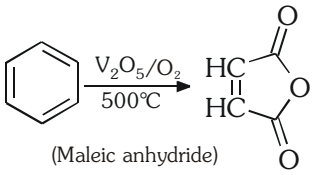
65. Benzene sulphonyl chloride

It is used to distinguish and separate (Hinsberg reagent) 1°, 2° and 3° amines.

66. Tetra ethyl lead (TEL)

Used as antiknock compound

67. V_2O_5

(I) 

(Maleic anhydride)

(II)