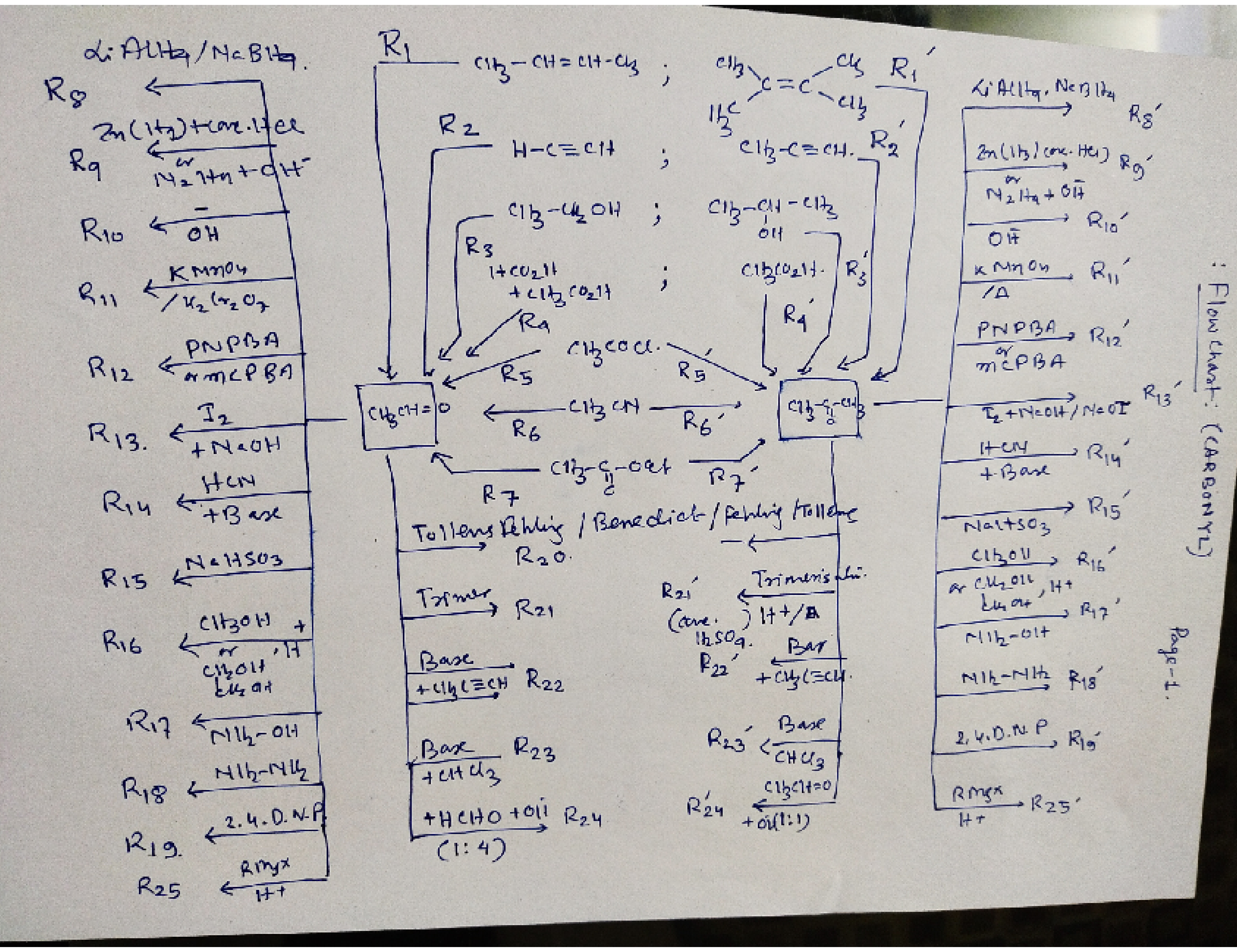


Flow chart : (CARBONYL)
Page-1
CH3-CH=CH-CH3 ; (CH3)2C=C(CH3)2
H-C≡CH ; CH3-C≡CH
CH3-CH2OH ; CH3-CH(OH)-CH3
HCO2H + CH3CO2H ; CH3CO2H
CH3COCl
CH3CH=O
CH3-C(=O)-CH3
CH3CN
CH3-C(=O)-OEt
R1 R2 R3 R4 R5 R6 R7
R1' R2' R3' R4' R5' R6' R7'
LiAlH4 / NaBH4 R8
Zn(Hg) + conc. HCl or N2H4 + OH⁻ R9
OH⁻ R10
KMnO4 / K2Cr2O7 R11
PNPBA or mCPBA R12
I2 + NaOH R13
HCN + Base R14
NaHSO3 R15
CH3OH + H, or CH2OH CH2OH R16
NH2-OH R17
NH2-NH2 R18
2.4.D.N.P R19
RMgX H+ R25
Tollens Fehling / Benedict / Fehling Tollens R20
Trimer R21
Base + CH3C≡CH R22
Base + CHCl3 R23
+HCHO + OH (1:4) R24
Trimeris. H+/Δ R21' (conc. H2SO4)
Base + CH3C≡CH R22'
Base CHCl3 R23'
CH3CH=O + OH(1:1) R24'
LiAlH4, NaBH4 R8'
Zn(Hg) conc. HCl or N2H4 + OH⁻ R9'
OH⁻ R10'
KMnO4 /Δ R11'
PNPBA or mCPBA R12'
I2 + NaOH / NaOI R13'
HCN + Base R14'
NaHSO3 R15'
CH3OH R16'
or CH2OH CH2OH, H+ R17'
NH2-OH
NH2-NH2 R18'
2.4.D.N.P R19'
RMgX H+ R25'

$R_1 / R_1' \Rightarrow O_3/Zn/H_2O$ or O_3/PPh_3.

$R_2 / R_2' \Rightarrow Hg^{2+}$ / dil. H_2SO_4 or $HgSO_4 / H_3O^+$.

$R_3' / R_3' \Rightarrow$ PCC; CrO_3 in acetone

$R_4 / = R_4' \Rightarrow Ca(OH)_2/\Delta$ or $Ca(OH)_2$ dry distillation.

$R_5 \Rightarrow H_2 / Pd / BaSO_4$ Rosenmund reduction.
or DIBALH.

$R_5' \Rightarrow (CH_3)_2Cd$ or $(CH_3)_2Cu$ li.

$R_6 \Rightarrow$ DIBALH or $SnCl_2 + HCl(aq)$

$R_6' \Rightarrow CH_3MgX$ followed by H_3O^+.

$R_7 \Rightarrow$ DIBALH

$R_7' \Rightarrow CH_3MgX$ (1eq)

$R_8 \Rightarrow CH_3CH_2OH$ (1° Alcohol)

$R_8' \Rightarrow CH_3-\underset{OH}{CH}-CH_3$. (2° Alcohol)

$R_9 \Rightarrow CH_3-CH_3$

$R_9' \Rightarrow CH_3CH_2-CH_3$.

$R_{10} \Rightarrow CH_3-CH=CH-CH=O$ (Crotonaldehyde.

at OH (5%) $CH_3-\underset{OH}{CH}-CH_2-CH=O$ (Aldol product)

$R_{10}' \Rightarrow CH_3-\underset{CH_3}{C}=CH-\overset{O}{C}-CH_3$ (Mesityl oxide)

at OH / 5°C

$CH_3-\underset{OH}{\overset{CH_3}{C}}-CH_2-\overset{O}{C}-CH_3$ (Aldol) $\Rightarrow$

$R_{11} \Rightarrow CH_3CO_2H$

$R_{11}' \Rightarrow (CH_3CO_2H + CO_2 + H_2O)$
at high temp only.

$R_{12} \Rightarrow CH_3CO_2H$
(Bayer villeger oxidation)

R_{12}' $CH_3-\overset{O}{C}-O-CH_3$

$R_{13} \Rightarrow HCO_2H$ (Iodoform)
(step down)

R_{13}' : $CH_3-\overset{O}{C}-OH$ (Iodoform)
(step down)

$R_{14} \Rightarrow CH_3-\underset{OH}{CH}-CN$ $\Leftarrow$ cyanohydrin $\Rightarrow$

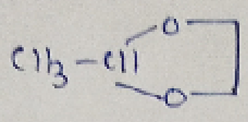
$R_{14}' \Rightarrow CH_3-\underset{OH}{\overset{CH_3}{C}}-CN$

R_{15} => $CH_3-CH(SO_3Na)-ONaH$ (white crystalline water soluble product)

R_{15}' => $CH_3-C(CH_3)(SO_3Na)-OH$.

R_{16} => $CH_3-CH(OCH_3)(OCH_3)$ Acetal

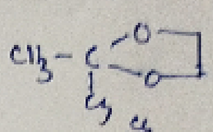
or



cyclic acetal.

R_{16}' => $CH_3-C(CH_3)(OCH_3)(OCH_3)$ ketal

or



cyclic ketal

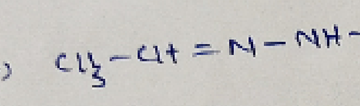
R_{17} => $CH_3-CH=N-OH$.

R_{17}' => $CH_3-C(CH_3)=N-OH$.

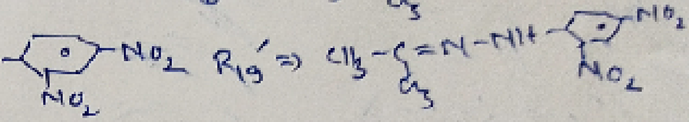
R_{18} => $CH_3-CH=N-NH_2$

R_{18}' => $CH_3-C(CH_3)=N-NH_2$

R_{19} =>



R_{19}' =>

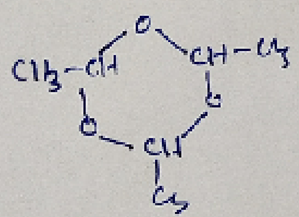


R_{20} => Tollens => Ag mirror. + $CH_3CO_2^-$

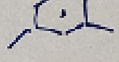
Fehling / Benedict => Cu_2O ↓ (reddish brown ppt) + $CH_3CO_2^-$

for ketone, with Tollens/Fehling / Benedict no reaction.

R_{21} =>



R_{21}' => Acid catalysed Aldol condensation product



(Mesitylene).

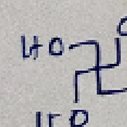
R_{22} => $H_3C-CH(OH)-C\equiv C-CH_3$.

R_{22}' => $CH_3-C(CH_3)(OH)-C\equiv C-CH_3$

R_{23} $H_3C-CH(OH)-CCl_3$

R_{23}' => $H_3C-C(CH_3)(OH)-CCl_3$ (chloretone)

R_{24} 3 times Aldol + one time crossed cannizaro pdt.



(Pentaerithritol).

R_{24}' => Crossed Aldol.

$CH_3-C(CH_3)(OH)-CH_2-CH(OH)-CH_3$ (major) +

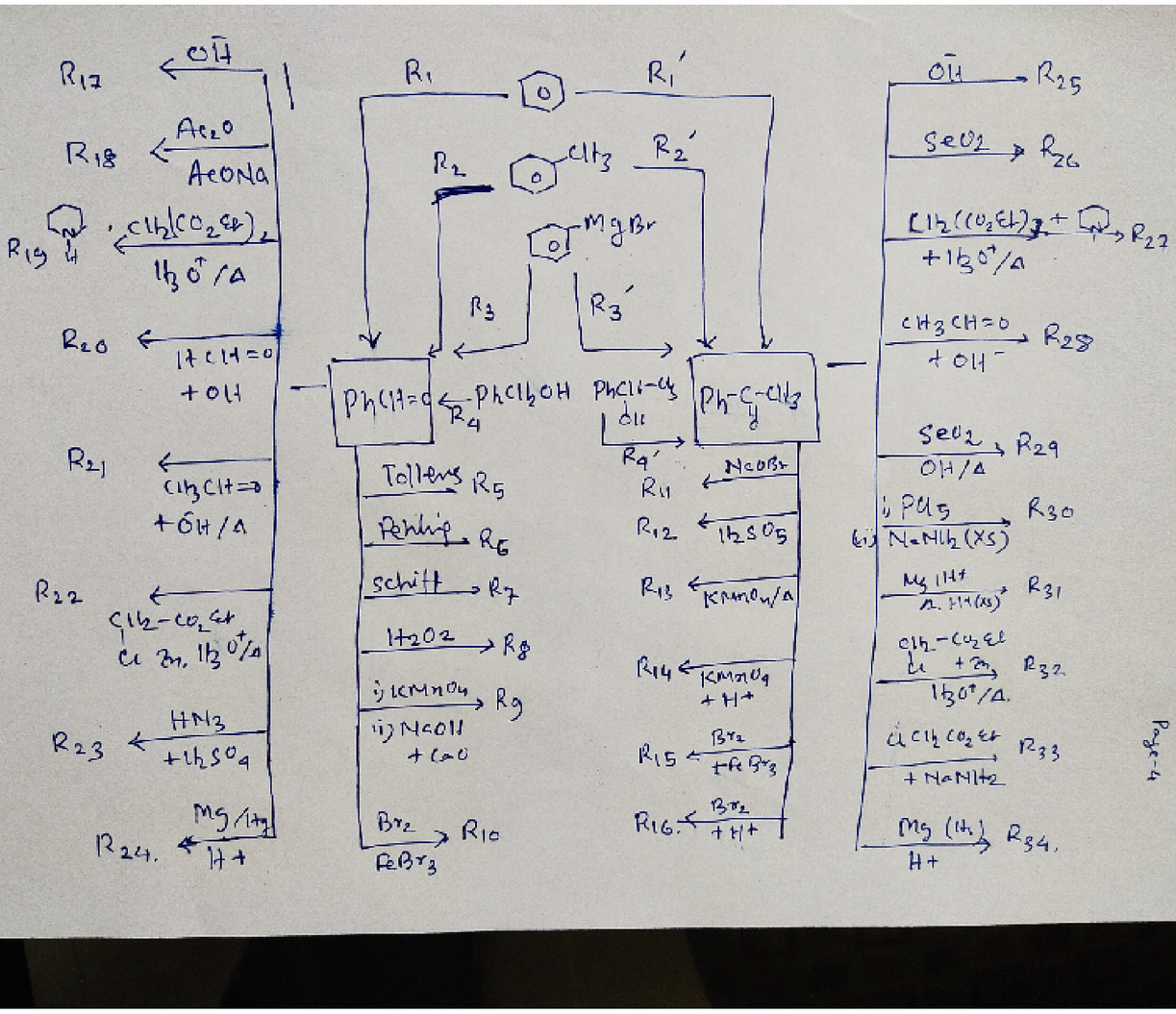
$CH_3-C(CH_3)(OH)-CH_2-CH=O$.

R_{25} $CH_3-CH(OH)-R$

(2° Alcohol)

R_{25}' => $CH_3-C(CH_3)(OH)-R$

(3° Alcohol)


R17
OH⁻
R18
Ac2O
AcONa
R19
CH2(CO2Et)2
H3O+/Δ
R20
HCH=O
+OH⁻
R21
CH3CH=O
+OH⁻/Δ
R22
CH2-CO2Et
Cl Br, H3O+/Δ
R23
HNO3
+H2SO4
R24.
Mg/Et2O
H+
R1
R1'
R2
R2'
CH3
MgBr
R3
R3'
PhCH=O
R4
PhCH2OH
PhCH-CH3
OH
R4'
Ph-C-CH3
O
Tollens
R5
Fehling
R6
Schiff
R7
H2O2
R8
i) KMnO4
ii) NaOH
+CaO
R9
Br2
FeBr3
R10
NaOBr
R11
H2SO5
R12
KMnO4/Δ
R13
KMnO4
+H+
R14
Br2
+FeBr3
R15
Br2
+H+
R16.
OH⁻
R25
SeO2
R26
CH2(CO2Et)2 + N
+H3O+/Δ
R27
CH3CH=O
+OH⁻
R28
SeO2
OH/Δ
R29
i) PCl5
ii) NaNH2 (xs)
R30
Mg, Et2O
2. HCHO(xs)
R31
CH2-CO2Et
Cl + Br
H3O+/Δ.
R32
Cl CH2CO2Et
+NaNH2
R33
Mg (Et2O)
H+
R34.

R_1 => CO + HCl + anhydrous $AlCl_3$ Gatterman Koch synthesis

or

HCN + HCl + anhydrous $AlCl_3$ Gatterman Aldehyde Synthesis.

R_1' => $CH_3-\overset{O}{\overset{\|}{C}}-Cl$ + $AlCl_3$ Friedel Craft Acylation

or

Ac_2O + $AlCl_3$ (Acylation in ring)

R_2 => CrO_2Cl_2 CCl_4 or Cr-acetate + H_2O (Etard reaction)

R_2' => $KMnO_4$; $SOCl_2$; $(CH_3)_2Cd$.

R_3 => HCN followed by H_3O^+ addition.

R_3' => $CH_3-C\equiv N$ followed by H_3O^+ addition.

R_4 => MnO_2 (oxidises Benzylic 1° Alcohol to aldehyde)

R_4' => MnO_2 (oxidises benzylic 2° Alcohol to ketone)

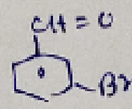
Also it can be Cu/300°C. (both R_4 & R_4').

With Tollens R_5 => $PhCO_2^-$ + Ag mirror.

With Fehling & Schiff, benzaldehyde no reaction.

R_8 => $PhCO_2H$ (With H_2O_2, Baeyer Villeger oxidation)

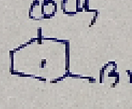
R_9 => PhH. (Oxidation followed by decarboxylation).

R_{10} =>  [EAS; bromination].

R_{11} => $PhCO_2^-Na^+$ (Bromoform reaction; step down).

R_{12} => $H_3C-\overset{O}{\overset{\|}{C}}-O-Ph$ [H_2SO_5 also can participate in Bayer Villeger Oxidation).

R_{13} / R_{14} => $PhCO_2K$ / $PhCO_2H$.

R_{15} =>  [EAS; bromination in ring].

R_{16} => $Ph-\overset{O}{\overset{\|}{C}}-CH_2-Br$ [Acid catalysed halogenation].

R_{17} => $PhCO_2^-$ + $PhCH_2OH$ [Cannizaro reaction)

disproportionation reaction

R_{18} ⇒ $PhCH=CH-CO_2H$ (Cinnamic Acid) ; Perkin reaction.

R_{19} ⇒ $PhCH=CH-CO_2H$ Knoevenagal condensation. Page-6.

R_{20} ⇒ $HCO_2^- + PhCH_2OH$ Crossed Cannizaro reaction.

R_{21} ⇒ $PhCH=CH-CH=O$. Claisen Schmidt reaction.

R_{22} ⇒ $PhCH=CH-CO_2H$ Reformatsky reaction

R_{23} ⇒ $PhC\equiv N. + PhNHCH=O$ schmidt reaction

R_{24} ⇒ $PhCH(OH)-CH(OH)Ph$ [Pinacol formation by free radical mechanism).

R_{25} ⇒ $Ph-C(=O)-CH=C(CH_3)-Ph$ Aldol condensation product

$Ph-C(=O)-CH_2-C(OH)(CH_3)-Ph$ Aldol product (OH) very low temp).

R_{26} ⇒ $Ph-C(=O)-CH=O$ [SeO_2 ⇒ Monocarbonyl → Dicarbonyl].

R_{27} ⇒ $PhC(CH_3)=CH-CO_2H$. Knoevenagal condensation.

R_{28} ⇒ $PhC(=O)-CH=CH-CH_3$ Crossed Aldol condensation.

R_{29} ⇒ $Ph-C(=O)-CH=O \longrightarrow PhCH(OH)-CO_2^-$ [Intra crossed Cannizaro reaction)

R_{30} ⇒ $Ph-C(Cl)(Cl)-CH_3 \xrightarrow[(X3)]{NaNH_2} Ph-C\equiv C^{(-)}\,Na^+$.

R_{32} ⇒ $Ph-C(CH_3)=CH-CO_2H$ Reformatsky reaction.

R_{33} ⇒ $Ph-C(CH_3)(O^-)-CH(Cl)-CO_2Et \longrightarrow Ph-C(CH_3)(O-CH)-CO_2Et$.

R_{34} ⇒ $Ph-C(CH_3)(OH)-C(OH)(Ph)-CH_3$

(Pinacol)

R_{31} ⇒ $Ph-C(CH_3)(Ph)-C(=O)-CH_3$

(Pinacolone).

Pinacol → Pinacolone rearrangement.