(B): $SnCl_2 + HCl$: (Stephen reduction)
$SnCl_2$ → very strong reducing agent. $Sn^{2+} \longrightarrow Sn^{4+} + 2e^-$
(unstable) (stable)

reaction is spontaneous.

Purpose: It converts $RCN \longrightarrow RCH=O$.

$R-C\equiv N + HCl \longrightarrow R-C\equiv\overset{+}{N}H$

$\downarrow +2e\ (Sn^{2+} \longrightarrow Sn^{4+} + 2e)$

$R\overset{\ominus}{C}=NH$

$\downarrow HCl$

$RCH=NH$

$\downarrow$ 2Eq. HCl.

$(RCH=NH)_2^{2+}\ SnCl_6^{2-}$

$\xleftarrow{H_2O}$ $RCH=O + NH_3\uparrow$

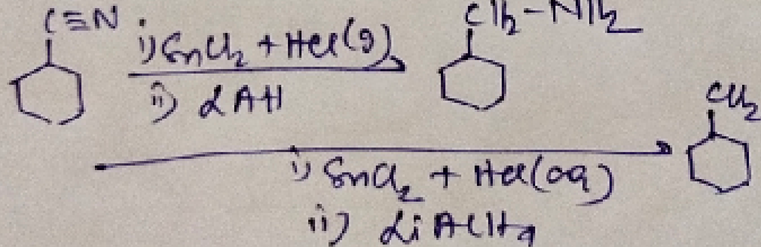
Aldimin stannichloride.
(Immene / Immiminium ion)

If HCl(g) is present, then final product is $RCH=NH$.

If HCl(aq) is present or H_3O^+ then final product is $RCH=O$.

To convert $RCN \longrightarrow RCH=O$

$R-C\equiv N \xrightarrow{DIBALH}$ or $SnCl_2 + HCl(aq) \longrightarrow RCH=O$ any one can be used.



(e) Red P + HI

It can reduce almost all functional group into alkane.

$RCO_2H \xrightarrow[+HI]{red\ P} RCH_3$

$RCH_2OH \xrightarrow{red\ P + HI} RCH_3$

$RCH=O \xrightarrow{red\ P + HI} RCH_3$

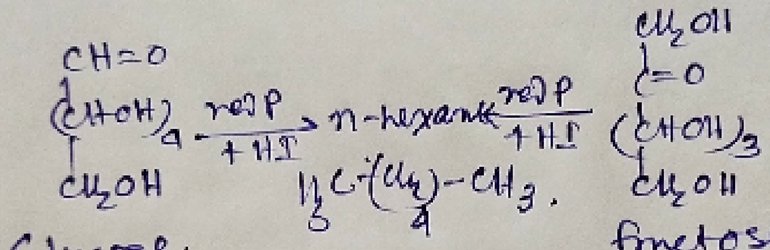
$R-\underset{\underset{O}{\|}}{C}-R \xrightarrow{red\ P + HI} RCH_2R$.

$RCH_2-Cl \xrightarrow{red\ P + HI} RCH_3$.

$RCO_2H \xrightarrow{red\ P + HI} RCH_3$

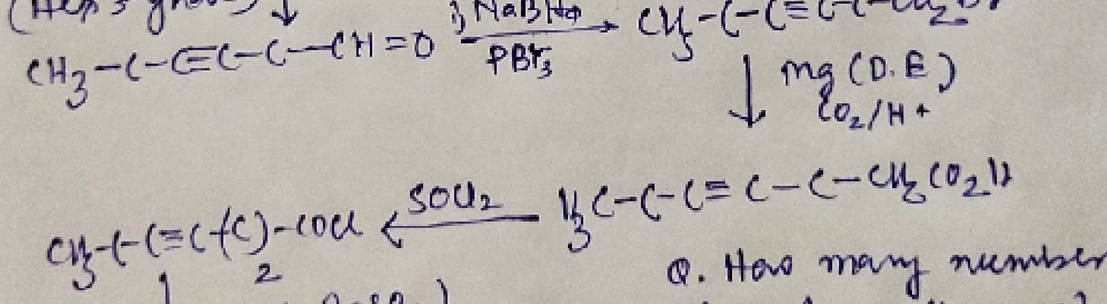
$\xrightarrow[\Delta]{NaOH + CaO} RH + CO_2\uparrow$

$\xrightarrow{NaOH/EL} R-R$.

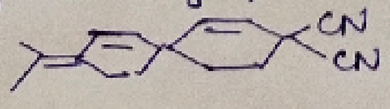


Glucose.

fructose.



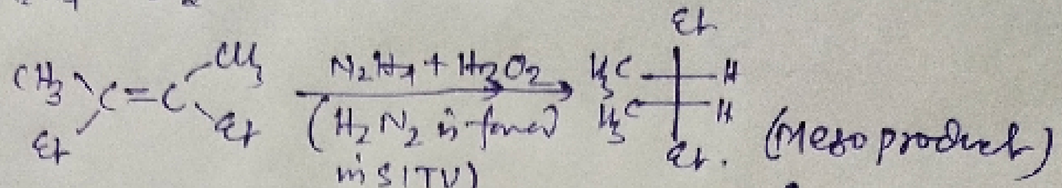
Q. How many number of moles of H_2 used for complete hydrogenation of given compound in presence of Pt.

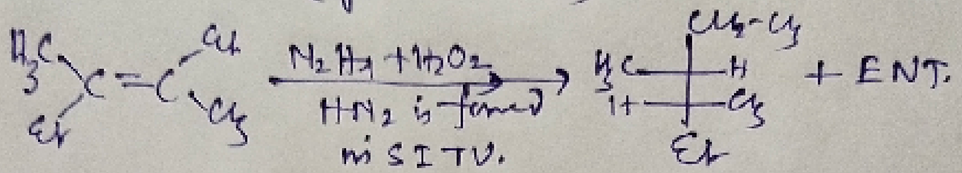


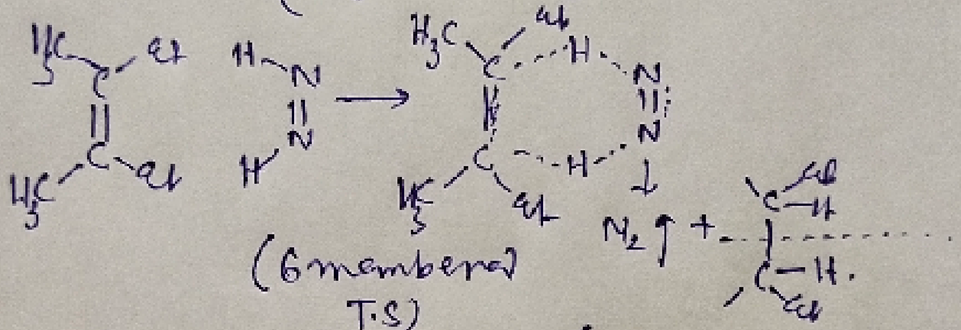
Ans: 7.

(d) $N_2H_4 + H_2O_2$

$N_2H_4 + H_2O_2 \longrightarrow H_2N_2 + H_2O$







$CH_3-CH_2-Cl \xrightarrow{LiAlH_4} CH_3-CH_3$

$(CH_3)_2CH-Cl \xrightarrow{LiAlH_4} (CH_3)_2CH_2$

$Me_3C-Cl \xrightarrow{LiAlH_4} H_2C=C(CH_3)_2$

$CH_3CH_2-Cl \xrightarrow{NaBH_4} CH_3-CH_3$ No reaction

$(CH_3)_2CH-Cl \xrightarrow{NaBH_4} (CH_3)_2CH_2$

$Me_3C-Cl \xrightarrow{NaBH_4} Me_3C-H$

$CH_3-CH_2-Cl \xrightarrow{Ph_3SnH} CH_3-CH_3$

$(CH_3)_2CHCl \xrightarrow{Ph_3SnH} (CH_3)_2CH_2$

$Me_3C-Cl \xrightarrow{Ph_3SnH} Me_3C-H.$

Reparation of alkane from carbonyl compand.

$RCH=O \xrightarrow[+\text{conc. HCl}]{Zn(Hg)} RCH_3$ ... clemenson reduction

$\xrightarrow[N_2H_4/\ominus OEt]{\Delta} RCH_3$ .... Wolff Kishner reduction.

$\xrightarrow[CH_2SH \\ CH_2SH]{\text{, raney Ni}(H_2)} RCH_3$ .... Mosingo reduction.

Wolff Kishner reduction : [Basic medium].

$RCH=O + NH_2-NH_2 \rightleftharpoons RCH=N-NH_2$

Hydrazone.

$RCH=N-NH_2 + \overset{\ominus}{O}R \rightleftharpoons RCH=N-\overset{\ominus}{N}H + ROH$

$\updownarrow$

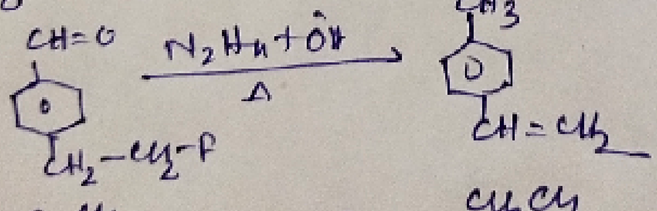
$RCH_2-N=NH \leftarrow \overset{\ominus}{R}CH-N=NH + ROH$

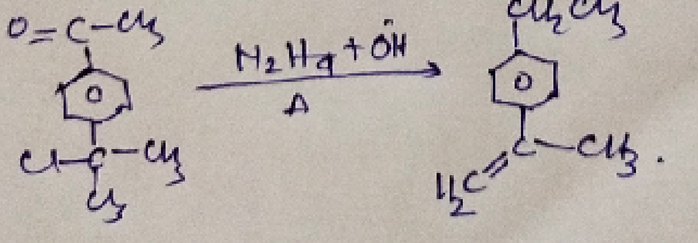
$RCH_2-N=NH \xrightarrow{RO^-} RCH_2-\overset{\leftarrow}{N}=\overset{\ominus}{N} \xrightarrow[+ROH]{} \overset{\ominus}{R}CH_2 \xrightarrow{ROH} RCH_3.$

$+ N_2\uparrow$

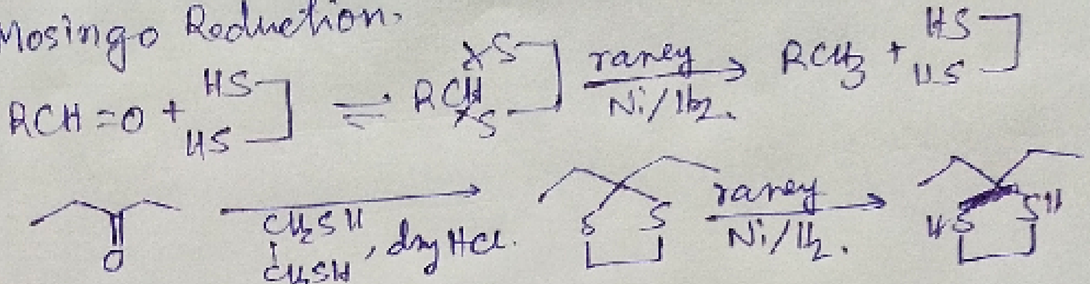
also $N_2H_4 + \bar{O}H/\Delta$ or $N_2H_4 + \bar{O}H$ $\begin{matrix} CH_2OH \\ CH_2OH \end{matrix}$ can be used.

$R-\underset{O}{\overset{\|}{C}}-R \xrightarrow[\Delta]{N_2H_4+\bar{O}H} RCH_2R.$

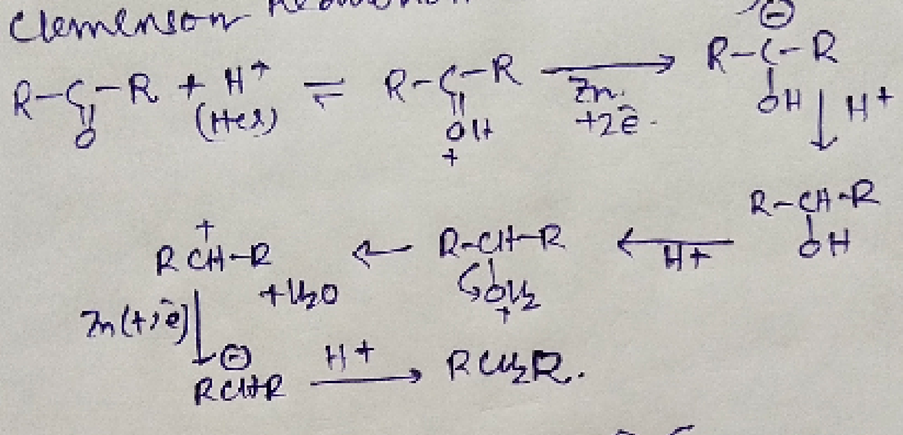




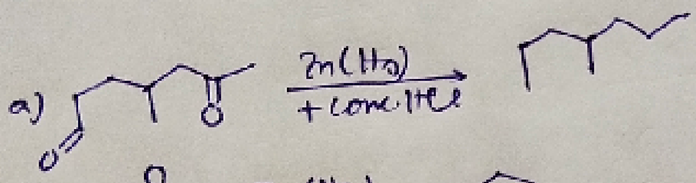
Mosingo Reduction.



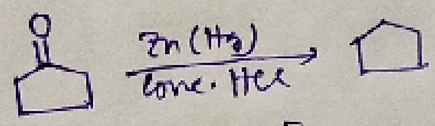
: Clemenson Reduction: Mechanism)



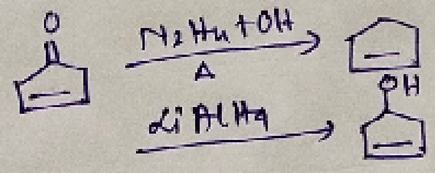
a)



b)

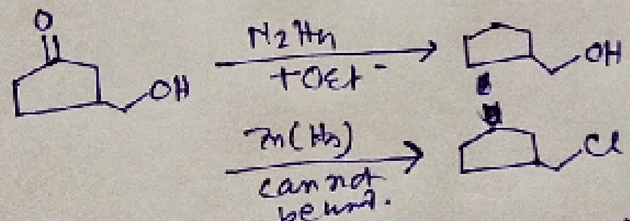


c)

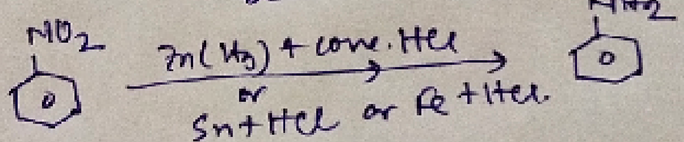


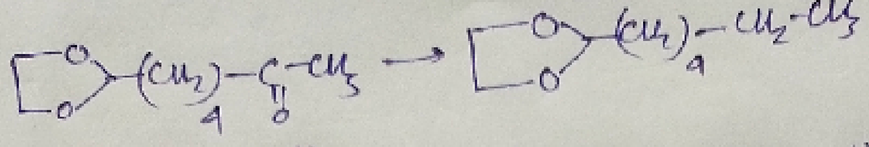
---(1) $Zn(Hg) + conc.HCl$ can not be used.

d)



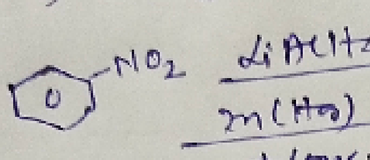
e)



f) 

The best option.

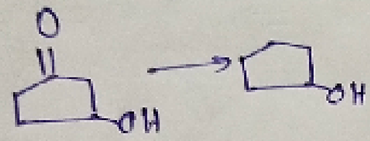
a) $Zn(Hg)$ + conc. HCl b) LAH c) SBH d) $N_2H_4 + \bar{O}H/\Delta$.

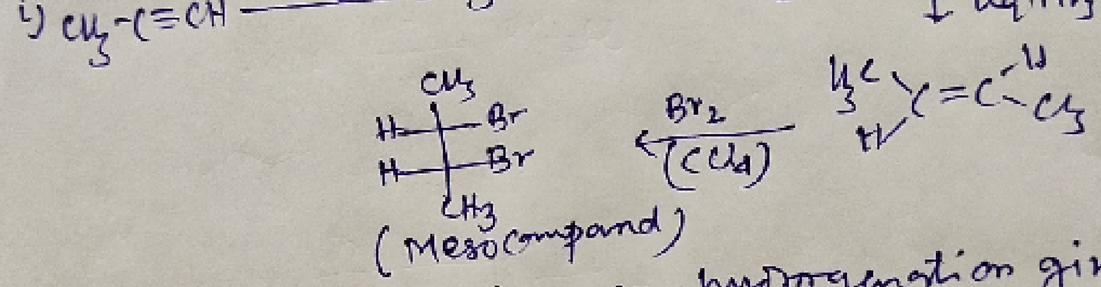
g) 

The best option is

a) $Zn(Hg)$ + conc. HCl (b) LAH

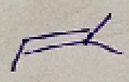
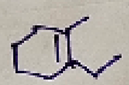
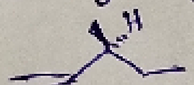
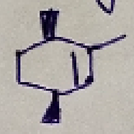
(c) SBH d) $N_2H_4 + \bar{O}H/\Delta$.

h) 

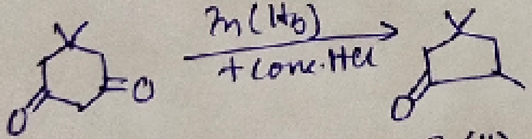
i) 

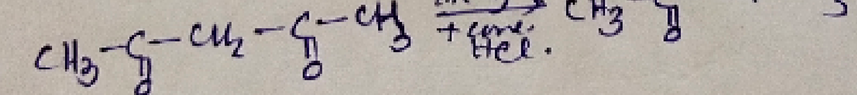
(Meso compound)

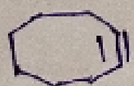
j) Identify alkene which on hydrogenation give racemic mixture?

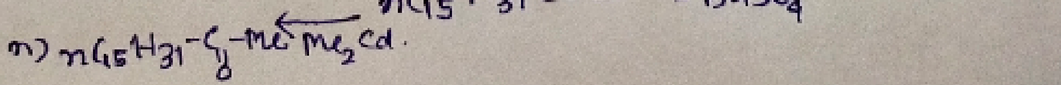
a)  b)  c)  d) 

Exception:

k) 

l) 

m)  Trans cyclooctene

n) 

1. Bouveault Blanc Reduction : Na/EtOH

$R-\underset{O}{\overset{}{C}}-H \xrightarrow{Na/EtOH} RCH_2OH$

$R-\underset{O}{\overset{}{C}}-R' \xrightarrow{Na/EtOH} R-\underset{OH}{\overset{H}{C}}-R'$

$R-\underset{O}{\overset{}{C}}-OEt \xrightarrow{Na/EtOH} RCH_2OH + EtOH.$

$R-\underset{O}{\overset{}{C}}-Cl \xrightarrow{Na/EtOH} RCH_2OH$

$R-\underset{O}{\overset{}{C}}-O-\underset{O}{\overset{}{C}}-R \xrightarrow{Na/EtOH} RCH_2OH + R'CH_2OH$

$RCH=\overset{\curvearrowright}{O} + Na(+e) \rightarrow R\dot{C}H-O^- \xrightarrow{EtOH} R\dot{C}H-OH$

$R\dot{C}H-OH \xrightarrow{Na(+\bar{e})} R\overset{\ominus}{C}H-OH \xrightarrow{EtOH} (1^\circ \text{ Alcohol.})\ RCH_2OH$

$R-\underset{O}{\overset{}{C}}-R + Na(+e) \rightarrow R_2\dot{C}-O^- \xrightarrow{EtOH} R_2\dot{C}-OH$

$R_2\dot{C}-OH \xrightarrow{Na(+\bar{e})} R_2\overset{\ominus}{C}-OH \xrightarrow{EtOH} R_2CHOH.$

Al-isopropoxide + Protic solvent (ROH)

$RCH=O + Al(OCHMe_2)_3 \xrightarrow[+ROH]{} RCH_2OH.$ 1° Alcohol.

$R_2C=O + Al(OCHMe_2)_3 \xrightarrow[+ROH]{} R_2CH-OH.$ 2° Alcohol.

It is example of Meerwin-Pondorf-Verley reduction. (M.P.V reduction)

$Al(OCHMe_2)_3$ is only used to reduce

$RCH=O \rightarrow RCH_2OH.$ (1° Alcohol)

$R_2C=O \rightarrow R_2CHOH$ (2° Alcohol).

$N_2H_4 + O\bar{E}t \Rightarrow$ reduce $R-CO-R \rightarrow RCH_2R.$

$N_2H_4 + H_2O_2 \Rightarrow$ reduce $C=C \rightarrow -CH_2-CH_2-$

multiple nonpolar bond. $N=N \rightarrow -NH-NH-$

$C\equiv C \rightarrow -CH_2-CH_2-$

: Alcohol Preparation :

REAGENTS USED: $LiAlH_4$; $NaBH_4$; B_2H_6 (Cat); $LiAlH(OtBu)_3$; H_2 (cat). $-78^\circ C$. Bouveault-Blanc Reduction. Na/EtOH M.P.V Reduction; $Al(OCHMe_2)_3$ + ROH.

: Starting Cpd :

$RCH=O \longrightarrow RCH_2OH$. LAH, SBH, B_2H_6; H_2 (cat), DiBAH....

$RCOR \longrightarrow R-\underset{OH}{CH}-R$ + $Al(OCHMe_2)_3$ + ROH + Na/EtOH.

~~RCOCl~~

$RCOCl \longrightarrow RCH_2OH$. LAH, SBH, H_2 (cat); Na/EtOH.

$RCO_2R \longrightarrow RCH_2OH$
$RCO_2H \longrightarrow RCH_2OH$
$R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R \longrightarrow RCH_2OH$
} LAH; B_2H_6; Na/EtOH. can be used.

$H_2(Ni)$ can not reduce RCO_2H, for ester yield is very low.

: Aldehyde preparation :

$SnCl_2 + HCl(aq)$; (Stephen reduction) DIBALH $-78^\circ C$; $H_2(Pd-BaSO_4)$ + S-quinoline. (Rosenmund reduction)

$R-C\equiv N \longrightarrow RCH=O$ $SnCl_2 + HCl(aq)$; DIBALH ($-78^\circ C$).

$R-\overset{O}{\overset{\|}{C}}-Cl \longrightarrow RCH=O$. DIBALH ($-78^\circ C$); $H_2(Pd-BaSO_4)$ S-quinoline.

$R-CO_2R$, $R-\overset{O}{\overset{\|}{C}}-NH_2$, $R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R$, $R-\overset{O}{\overset{\|}{C}}-NR_2$ $\longrightarrow RCH=O$ DIBAL-H ($-78^\circ C$)

Amine Preparation: Reagent used.

$RNO_2 \longrightarrow RNH_2$ Sn + HCl; $Zn(Hg)$ + conc. HCl $H_2(Ni)$; LAH.

$RCN \longrightarrow RCH_2NH_2$

$RCH=NH \longrightarrow RCH_2NH_2$ LAH; $H_2(Ni)$

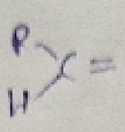
$RCONH_2 \longrightarrow RCH_2NH_2$ ~~Sn + HCl~~ LAH & $H_2(Ni)$

: Hydrocarbon preparation:

: Cis alkene:

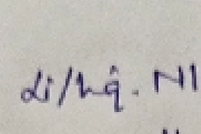
Lindlar catalyst; $H_2(Pd-BaSO_4)$; $H_2(Pd-CaCO_3)$

P-2 catalyst. $H_2(Ni_2B)$; $N_2H_4 + H_2O_2$

$R-C\equiv C-R \longrightarrow$  all above reagents can be used.

: Trans alkene:

$Na/Liq.\ NH_3$ or $Li/liq.\ NH_3$ (Birch Reduction)

$R-C\equiv C-R \longrightarrow$  all above reagents can be used.

: Alkane:

: Reagents used:

a) $Zn(Hg) + conc.\ HCl$ (clemenson reduction).

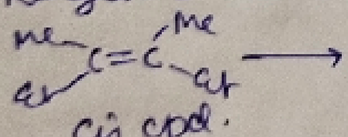
b) $N_2H_4 + \overset{\ominus}{O}Et/\Delta$ or $\bar{O}H/\Delta$ (W.K. Reduction).

c) red P + HI d) $CH_2(SH)-CH_2(SH)$ + raney Ni(H_2). Mosingo reduction.

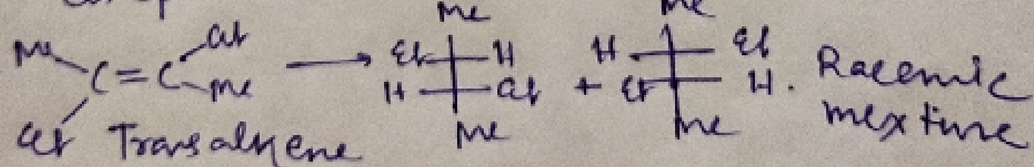
$R-CH=O \longrightarrow RCH_3$; $RCOR \longrightarrow RCH_2R$.

all above reagents can be used.

: Reagents used: $N_2H_4 + H_2O_2$; $H_2(Ni)$.

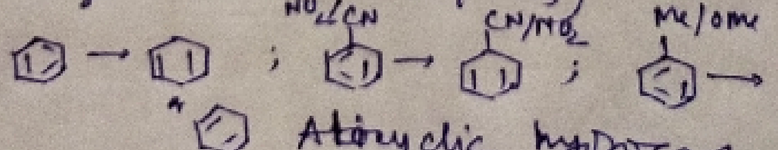


cis cpd. Meso. syn addition.



Trans alkene Racemic mixture

: Reagent used; $Na(liq.\ NH_3)$



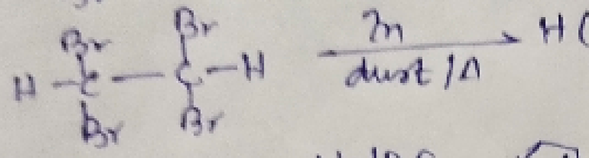
Alicyclic hydrocarbon.

: Alkane: Zn dust/Δ ; NaI/acetone ; Na/D.E

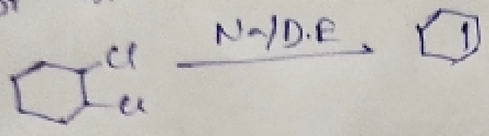
$CH_2(Br)-CH_2(Br) \xrightarrow{Zn/\Delta} CH_2=CH_2$. (Dehalogenation)

$CH_3-CH(Br)-CH(Br)-CH_3 \xrightarrow[acetone]{NaI} CH_3-CH=CH-CH_3$.

$CH_2(Br)-CH_2(Br) \xrightarrow[D.E]{Na} CH_2=CH_2$ Wurtz Reaction.



$\xrightarrow{Zn\ dust/\Delta} HC\equiv CH + ZnBr_2$



: Alkane: $LiAlH_4$; $NaBH_4$; Ph_3SnH.

$RCH_2-X \longrightarrow RCH_3$ [LAH ; TPH].

$R_2CHX \longrightarrow R_2CH_2$ [LAH, SBH, TPH].

$R_3C-X \longrightarrow R_3C-H$ [SBH, TPH].

: Alkane: Red P + HI.

$RCO_2H \longrightarrow RCH=O \longrightarrow RCH_2OH \longrightarrow RCH_3$

$RCH=O \longrightarrow RCH_2OH \longrightarrow RCH_3$

$RCH_2OH \longrightarrow RCH_3$

$RCH_2Cl \longrightarrow RCH_3$.

: Alkane:

$Zn(CH_3CO_2H)$; Mg ; H^+

$R-X \xrightarrow[ii)AcOH]{i)\ Zn} R-H$ $\qquad R-X \xrightarrow[ii)H^+]{i)\ Mg} R-H$

$R-X + Zn \longrightarrow RZnX \xrightarrow{AcOH} R-H$

$R-X + Mg \longrightarrow RMgX \xrightarrow[NH_4Cl]{H^+} R-H$.