Alkyl Halides

EXERCISES

ELEMENTARY

Q.1 (3)

$CH \equiv CH \xrightarrow{HBr} CH_2 = CHBr \xrightarrow{HBr} CH_3-CHBr_2$ (Gem dihalide)

Q.2 (1)

$C_3H_8 + Cl_2 \xrightarrow{Light} C_3H_7Cl + HCl$

This is an example of substitution reaction. Hydrogen atom of alkane is replaced by halogen atom.

Q.3 (1)

Q.4 (2)

$RX + Mg \xrightarrow[\text{ether}]{\text{Dry}} \underset{\text{Grignard's reagent}}{R-Mg-X} \quad (X = Cl, Br, I)$

Q.5 (2)

$C_6H_5-CH_2-Cl + KCN(aq) \rightarrow C_6H_5-CH_2-C \equiv N + KCl$

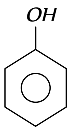
Q.6 (4)

$\xleftarrow[\substack{\text{high.M.w.}\\ \text{high D}}]{RI>RBr>RCl>RF} \qquad \xrightarrow{R-F>R-Cl>R-Br>RI}$

↓

(R – F) high bond energy, high stability

Q.7 (1)



$- C_2H_5I \xrightarrow[C_2H_5OH]{\text{Anhy.}} C_6H_5OC_2H_5$

Q.8 (3)

$C_2H_5ONa + BrC_2H_5 \rightarrow C_2H_5-O-C_2H_5 + NaBr$

Williamson's synthesis

Q.9 (2)

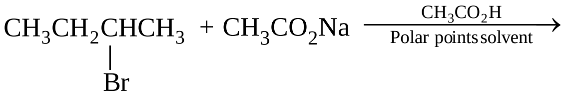
Q.10 (1)

Q.11 (2)

Alkyl halides give alkane when react with sodium in ether. This is called Wurtz reaction.

$R-Cl + 2Na + R-Cl \xrightarrow{ether} \underset{alkane}{R-R} + 2NaCl$

Q.12 (3)



$$\underset{\substack{|\\ Br}}{CH_3CH_2CHCH_3} + CH_3CO_2Na \xrightarrow[\text{Polar points solvent}]{CH_3CO_2H}$$

S_N2

Q.13 (1)

SN^2 Substitution nucleophilic bimolecular order of different alkyl halides. $1^o > 2^o > 3^o$

SN^1 Substitution nucleophilic unimolecular order of different alkyl halides , $3^o > 2^o > 1^o$.

Q.14 (3)

Q.15 (1)

Q.16 (1)

$(CH_3)_3COH + PhMgBr \longrightarrow PhH + (CH_3)_3COMgBr$

JEE-MAIN
OBJECTIVE QUESTIONS

Q.1 (1)

Q.2 (2)
According to carboction stability

Q.3 (2)

Q.4 (D)
Q.5 (1)

Q.6 (4)
R–Br & R – I cannot not prepared by Darzen reaction because $SOBr_2$ and SOI_2 are unstable.

Q.7 (2)

Q.8 (3)

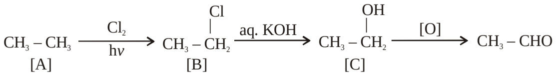
Q.9 (C)
Halides are good leaving group.
Q.10 (3)

Q.11 (B)

$Ag_2O + HOH \longrightarrow AgOH$

$Ag-\ddot{\underset{\cdot\cdot}{O}}-H + R-\overset{\delta+}{}\overset{\delta-}{X} \longrightarrow R-OH + AgX$

Q.12 (2)



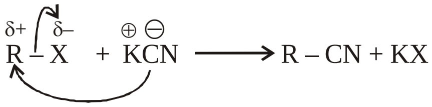
$$\underset{[A]}{CH_3-CH_3} \xrightarrow[h\nu]{Cl_2} \underset{[B]}{CH_3-\overset{\overset{Cl}{|}}{C}H_2} \xrightarrow{aq.\ KOH} \underset{[C]}{CH_3-\overset{\overset{OH}{|}}{C}H_2} \xrightarrow{[O]} CH_3-CHO$$

Q.13 (1)

Q.14 (1)

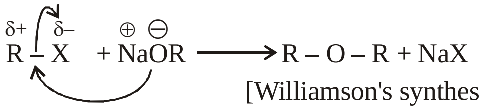
Q.15 (3)

Q.16 (2)



$$\overset{\delta+}{R}-\overset{\delta-}{X} + \overset{\oplus}{K}\overset{\ominus}{CN} \longrightarrow R-CN+KX$$

Q.17 (1)



$$\overset{\delta+}{R}-\overset{\delta-}{X} + \overset{\oplus}{Na}\overset{\ominus}{OR} \longrightarrow R-O-R+NaX$$

[Williamson's synthesis]

Q.18 (3)

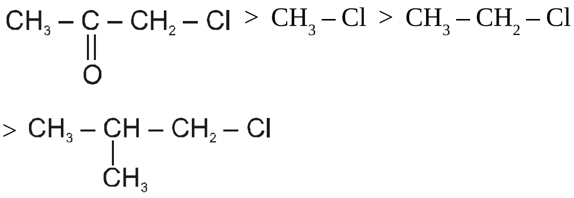
Q.19 (2)

Q.20 (2)

According to stability of carbocation.

Q.21 (1)

Q.22 (3)



$$CH_3-\underset{\underset{O}{\|}}{C}-CH_2-Cl > CH_3-Cl > CH_3-CH_2-Cl > CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-Cl$$

Q.23 (2)

Inversion product will be more than retention product due to close ion pair formation.

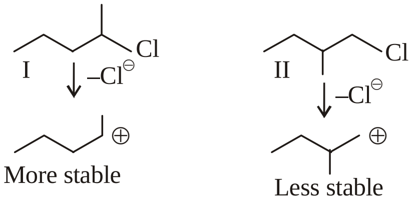
Q.24 (2)

Q.25 (3)

Intermediate carbocation of ‘C’ is more stable than, A, B, D compound.

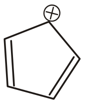
Q.26 (3)

Reactivity of alkyl halide increases with increase of stability of intermediate carbocation. Stability of carbocation of I is more than II only in ‘C’ option due to more hyperconjugation



Q.27 (3)

S_{N^1} Reaction intermediate (carbocation) of compound–C is unstable due to anti-aromaticity.



Antiaromatic
(Unstable)
Carbocation

Q.28 (3)

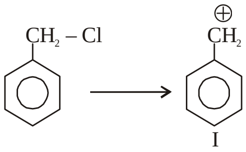
It is SN_2 reaction, so rate of reaction will :

Rate = k $[CH_3Br]\ [\overset{\ominus}{O}H]$

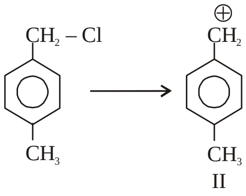
Q.29 (4)

Alkyl halide which produces less stable carbocation are lens reactive towards SN^1 – Reaction but more reactive towards SN^2 reaction

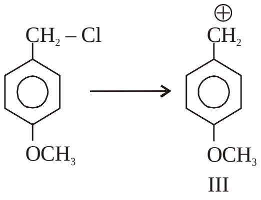
(A)



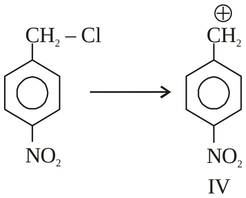
(B)



(C)



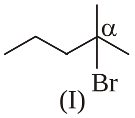
(D)



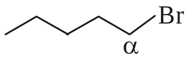
Stability order of carbocation = III > II > I > IV

Q.30 (1)

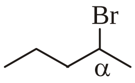
Q.31 (3)



(I)



(II)



(III)

Greater the steric hindrance around α-carbon of alkyl halide smaller will reactivity of alkyl halide towards SN^2 – Reaction.

Q.32 (2)

T.S. of compound 'B' is more stable than other.

Q.33 (4)

Due to more resonance in compound 'D' C–Cl bond acquire more double bond character, so replacement of Cl^- becomes difficult.

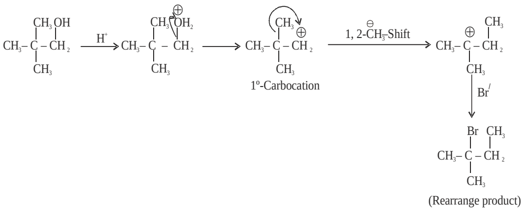
Q.34 (3)

Due to resonance stablisation of carbocation compound show SN^1 – mechanism, due to less steric hindrance around α-carbon it also show SN^2 mechanism.

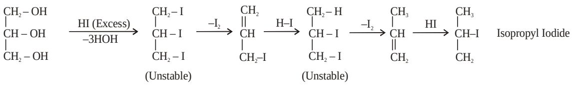
Q.35 (1)

Due to more steric hinderance around nucleophilic atom, the nucleophilic nature of Me_3CO^- becomes very less.

Q.36 (3)

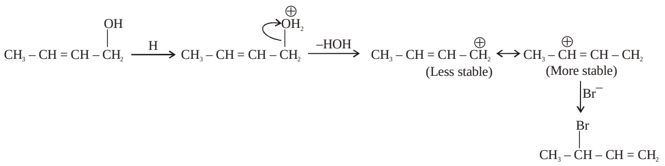


Q.37 (2)



Q.38 (2)

Q.39 (2)



Q.40 (3)

Reaction intermediate carbocation of compound 'C' is most stable than carbocation of other molecules.

Q.41 (2)

Reaction intermediate carbocation of compound 'C' is more stable than carbocation of other molecules

Q.42 (1)

Alkyl halide having tendency to form more stable carbocation will have more tendency to show SN reaction by SN^1–Mechanism stability order of carbocation of compound II > III > IV > I due to hyperconjugation.

Q.43 (4)

Due to double bond character of C–Cl bond of chlorobenzene (2). The C–Cl bond of chlorobenzene does not breack due to which precipitate of AgCl does not obtained.

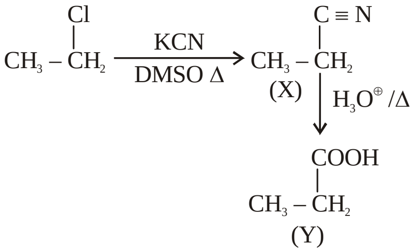
Q.44 (3)

$$2R-X+Ag_2O \rightarrow R-O-R+2AgX$$

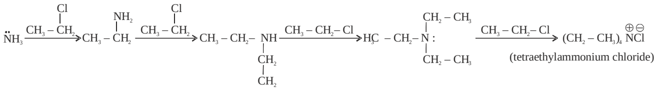
Q.45 (2)

Q.46 (4)

Q.47 (4)



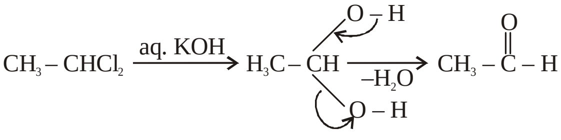
Q.48 (4)



Q.49 (1)

Lesser number of carbon atom lesser will boiling point more will volatile character

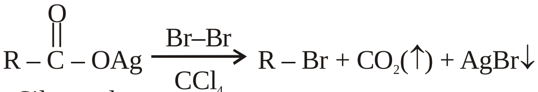
Q.50 (2)



Cemdiol (Unstable)

Q.51 (2)

Borodiene-Hunsdiecker's reaction



$$R-\overset{\overset{\displaystyle O}{\|}}{C}-OAg \xrightarrow[CCl_4]{Br-Br} R-Br + CO_2(\uparrow) + AgBr\downarrow$$

Silver salt
of carboxylic acid

Q.52 (2)

Because reaction is unimolecular reaction (SN^1 – Rxn). In this reaction rate of reaction 'R' depends only upon concentration of alkyl halide not on $\overset{\ominus}{O}H$

$R = K [(CH_3)_3CBr]$

Q.53 (2)

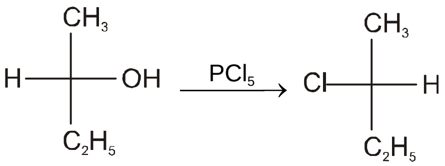
S_N2 mechanism is a single step concerted process and proceed through transition state.

Q.54 (2)

Q.55 (2)

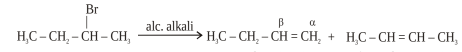
S_N2 Mechanism.

Q.56 (2)



Product is R - 2- Chlorobutane

Q.57 (4)

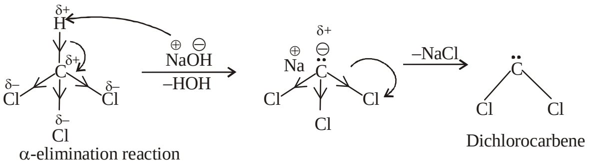


$$H_3C-CH_2-\overset{\overset{\displaystyle Br}{|}}{C}H-CH_3 \xrightarrow{\text{alc. alkali}} H_3C-CH_2-\overset{\beta}{C}H=\overset{\alpha}{C}H_2 + H_3C-CH=CH-CH_3$$

[Reaction occure by Saytzeff's Rule] α-Butylene (20%) β-Butylene (80%)

Q.58 (2)

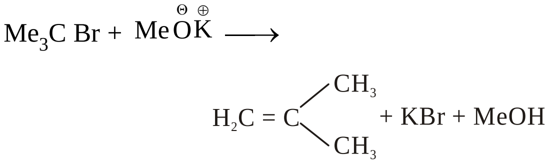
Q.59 (2)



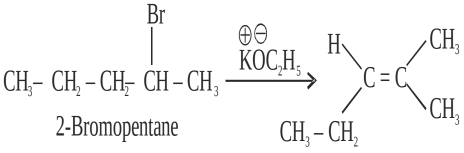
α-elimination reaction

Dichlorocarbene

Q.60 (1)



Q.61 (1)



The above elimination anti-elimination process.

Q.62 (4)

Q.63 (3)

Q.64 (1)

Q.65 (C)

Reaction occurs by Anti-Markonikov's rule.

Q.66 (A)

Q.67 (B)

Q.68 (3)

Q.69 (1)

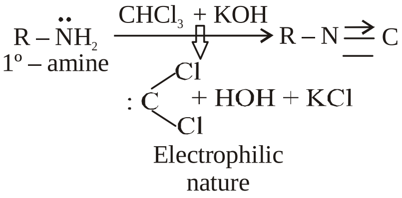
Q.70 (1)

Q.71 (3)

Q.72 (3)

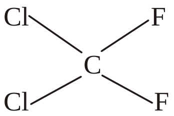
Q.73 (1)

Q.74 (A)



[Carbylamine reaction (Isocyanide test)]

Q.75 (4)



Dichlorodifluoromethane

Q.76 (2)

Q.77 (A)

Q.78 (2)

$$\underset{1^{\circ}\ \text{amine}}{R-\ddot{N}H_2} + CHCl_3 + 3KOH \longrightarrow R-NC + 3KCl + 3H_2O$$

Carbyl amine reaction
(Isocyanide test)

Q.79 (A)

JEE-ADVANCED OBJECTIVE QUESTIONS

Q.1 (A)

S_N1 reactions occur through the intermediate formation of carbocations.

Q.2 (C)

Q.3 (B)

$$CH_3-CH_2-CH_2-CH_2-OH \xrightarrow{HBr} CH_3-CH_2-CH_2-CH_2-Br$$

Unbranched 1° alcohol gives S_N2 reaction with HX.

Q.4 (B)

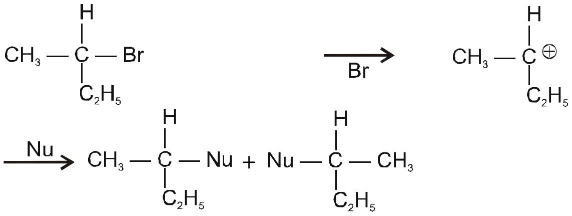
Q.5 (D)

Q.6 (B)

Q.7 (B)

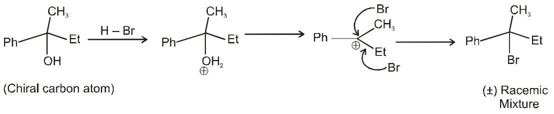
Q.8 (C)

Q.9 (B)



Q.10 (B)

Q.11 (C)



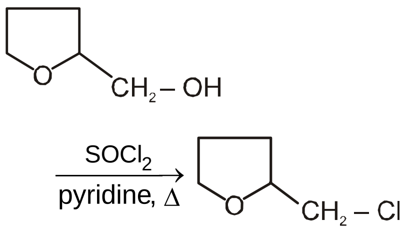
Q.12 (A)

Q.13 (A)

$$CH_3-CH_2-CH_2-O-CH_2-CH_3 \xrightarrow{HCl/\Delta} CH_3-CH_2-CH_2-OH + CH_3-CH_2-Cl$$

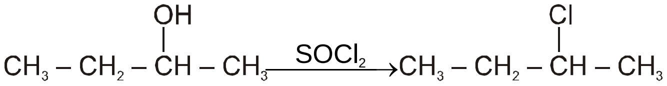
Q.14 (A)

Q.15 (A)



It is S_N2 reaction.

Q.16 (B)

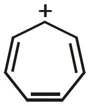


$$CH_3-CH_2-\underset{}{\overset{OH}{CH}}-CH_3 \xrightarrow{SOCl_2} CH_3-CH_2-\overset{Cl}{CH}-CH_3$$

It is S_Ni mech so retenion of configuration.

Q.17 (B)

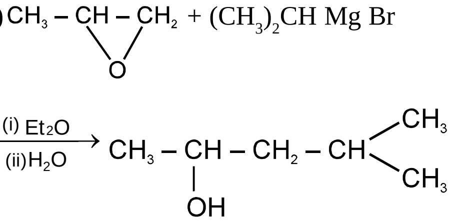
Due to formation of stable carbocation →



(Tropyllium cation)

Q.18 (C)

(C)



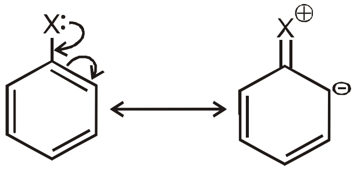
Q.19 (C)

Q.20 (B)

Q.21 (A)

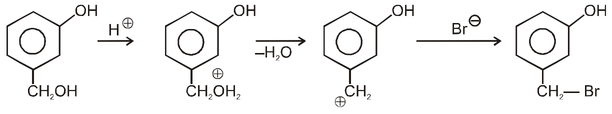
Q.22 (D)

In aryl halides the C – X bond has partial double bond character due to resonance so the cleavage of C – X bond becomes difficult.

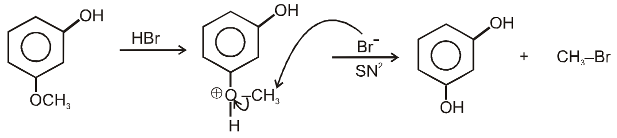


Q.23 (A)

(A)



(B)



Q.24 (A)

Rate of S_N1 reaction is a

t Bu X > iso-PrX > EtX > MeX

So order of activation energy

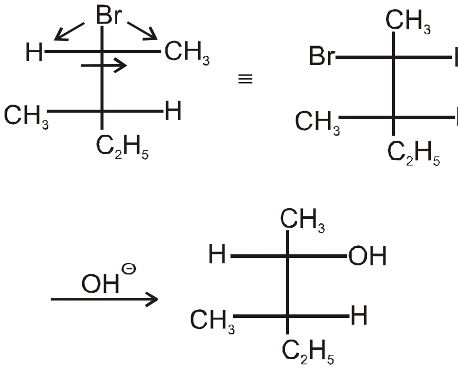
t – BuX < iso-PrX < EtX < MeX

order of ionisation energy

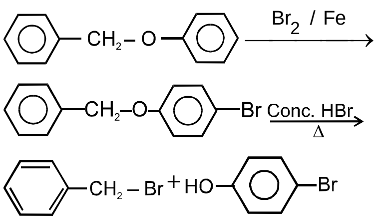
t BuX < iso-PrX < EtX < MeX

Q.25 (C)

Q.26 (B)



Q.27 (A)



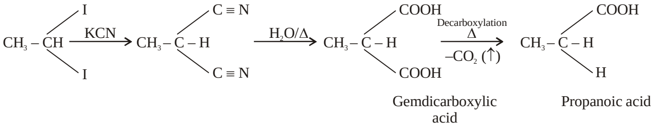
Q.28 (D)

I ⇒ Only one T.S. So it is for S_N2 and ΔH = –ve.

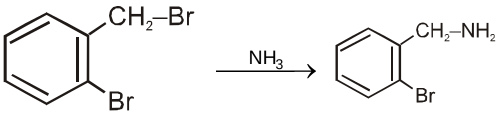
II ⇒ Only one T.S. So it is for S_N2 and ΔH = +ve.

III ⇒ More than one T.S. so it is for S_N1 and 1st step is rds.

Q.29 (D)

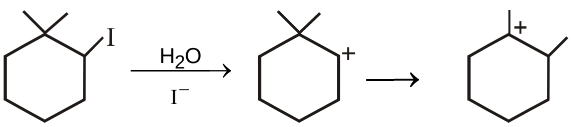


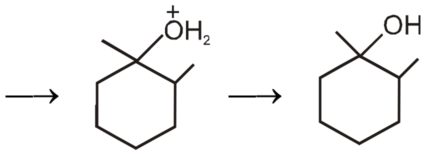
Q.30 (A)



Because aromatic halides do not give S_N reaction in normal conditions.

Q.31 (A)



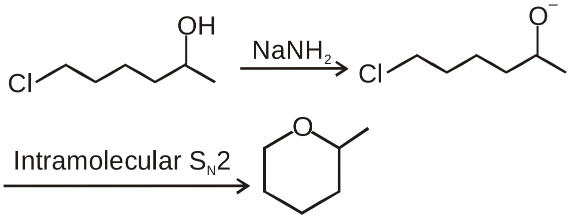


Q.32 (D)

Q.33 (A)

Q.34 (A)

Q.35 (D)



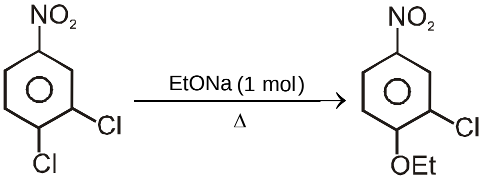
Q.36 (C)

Q.37 (D)

Q.38 (A)

Q.39 (C)

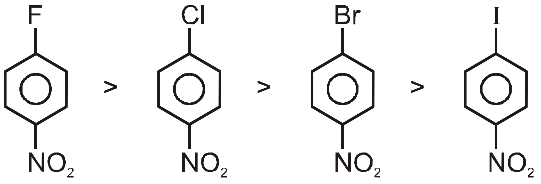
Q.40 (A)



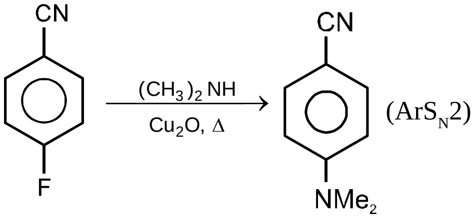
[– M effect of – NO_2 group at para position]

Q.41 (D)

Rate of ArS_N2 reaction



Q.42 (B)



Q.43 (A)

Q.44 (A)

Q.45 (C)

Q.46 (B)

JEE-ADVANCED

MCQ/COMPREHENSION/COLUMN MATCHING

Q.1 (A,B,C,D)

Q.2 (B,C)

Rate of solvolysis $\propto$ Stability of carbocation.

Q.3 (A,B,C)

In compound 'A' & 'C' due to double bond character between C–Br bond the breaking of C–Br bond becomes tough. In compound 'B' back side position of leaving group is not free and also T.S. in compound 'B' is not possible So SN^2–Reaction.

Q.4 (A, B)

$k_1' < K_1$ $\Leftarrow$ due to steric hinderence of nucleophile

$k_2' < K_2$ $\Leftarrow$ due to steric hinderence of nucleophile

$k_1 > K_2$ $\Leftarrow$ due to steric hinderence of R – X

$k_1' > k_2'$ $\Leftarrow$ due to steric hinderence of R – X

Q.5 (A,C)

Alkyl halide having less bulkier group at target α–C-atom are more reactive towards SN^2–reaction.

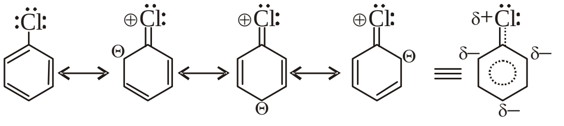
Q.6 (A,C)

It is an example of S_N2 reaction.

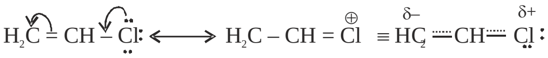
Q.7 (A,C,D)

Q.8 (A, C)

In Ph–Cl due to delocalisation of lone pair electron of Cl with π-electrons of phenyl ring, C-Cl bond acquire double bond character and becomes strong.



Similarity due to delocalisation of electron C–Cl bond in vinyl halide also acquire double character so does not break by nucleophil attack.

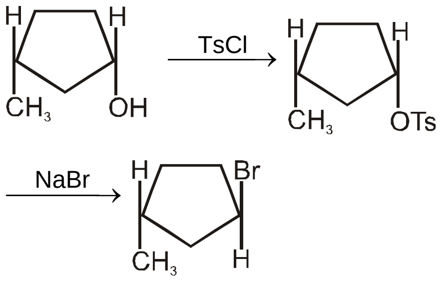


$$H_2C = CH - \ddot{C}l: \longleftrightarrow H_2C - CH = \overset{\oplus}{Cl} \equiv \overset{\delta-}{HC_2} \cdots CH \cdots \overset{\delta+}{Cl}:$$

Q.9 (B, C)

In the case 'B' and 'C' rearrangement does not occure in SN^1 reaction also so we get normal product. Due to formation of T.S. In SN^2 also we get normal product. So SN^1 and SN^2 both product are similar & normal.

Q.10 (A, B)



Q.11 (A,B)

`S_N2 Reaction $\longrightarrow$ High conc. of Nucleophile

$\longrightarrow$ Strong Nu^{Θ}

$\longrightarrow$ Polar Aprotic solvent

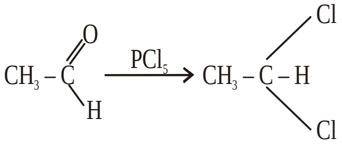
$\longrightarrow$ Rate of reaction

= 3º RX < 2º RX < 1º RX < CH_3–X

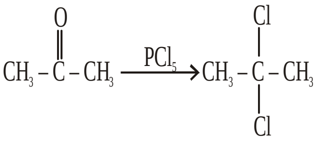
Q.12 A,B,C,D)

Q.13 (D)

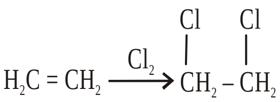
Q.14 (A,B,D)

(A)  Gem-dichloride

$$CH_3-\underset{H}{\overset{O}{C}} \xrightarrow{PCl_5} CH_3-\underset{Cl}{\overset{Cl}{C}}-H$$

(B)  Gem-dichloride

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow{PCl_5} CH_3-\underset{Cl}{\overset{Cl}{C}}-CH_3$$

(C)  Viccinal-dichloride

$$H_2C = CH_2 \xrightarrow{Cl_2} \overset{Cl}{CH_2}-\overset{Cl}{CH_2}$$

(D) $CH_2 = CHCl \xrightarrow{H-Cl} CH_3 - CHCl_2$ Gem-dihalide

Q.15 (B,C)

In first step acid base reaction takes place and after that stable carbocation intermediate is formed.

Q.16 (C,D)

Q.17 (A,B,C)

Q.18 (A,B)

Q.19 (B)

I ⟶ Inversion of configuration ⟶ S_N2

II ⟶ Racemisation takes place ⟶ S_N1

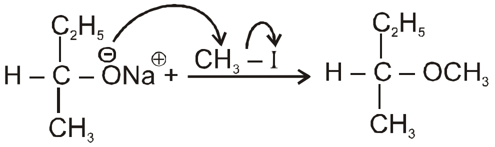
III ⟶ Retention of configuration ⟶ S_Ni

IV ⟶ Inversion of configuration ⟶ S_N2

Q.20 (C)

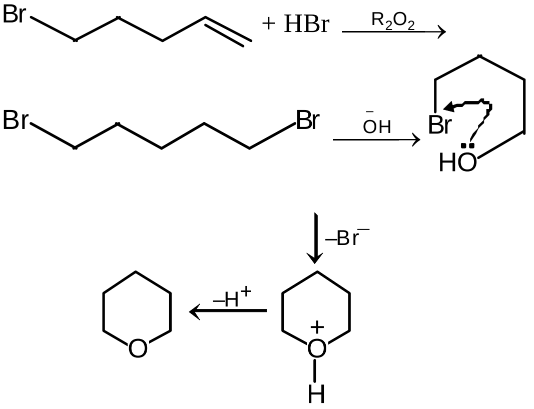
In this reaction retention of configuration takes place so it is S_Ni mechanism.

Q.21 (B)

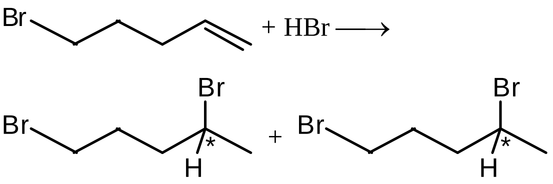


Retention in configuration.

Q.22 (C)



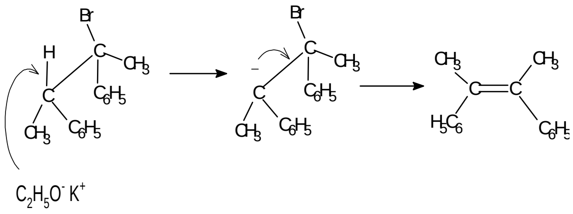
Q.23 (B)



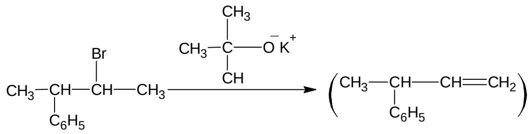
Q.24 (A)

Rate of solvolysis ∝ stability of intermediate carbcation.

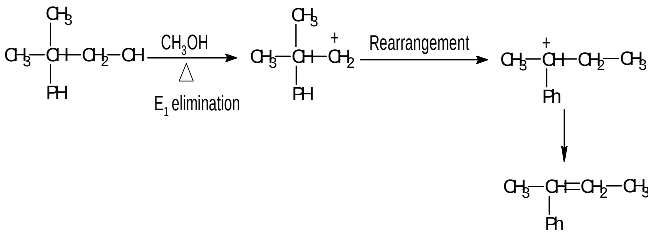
Q.25 (B)



Q.26 (B)

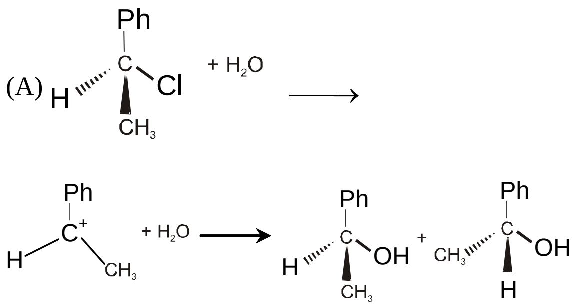


Q.27 (B)

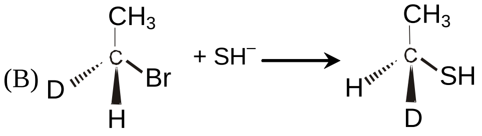


Q.28 (A) S,T (B) P,S,T (C) U, (D) Q, (E) T,U

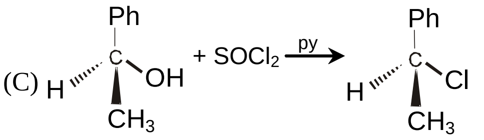
Q.29 (A) → q,s (B) → r, (C) → p (D) → r



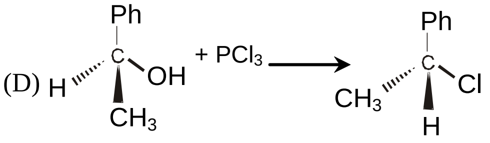
(Racemisation)



(Inversion)



(Retention)



(Inversion)

Q.30 (A) S ; (B) Q ; (C) R ; (D) P

Q.31 (A) 3 ; (B) 2 ; (C) 1 ; (D) 2

Q.32 (A) 4 ; (B) 3, 4 ; (C) 3 ; (D) 1, 2

Q.33 (A) Q ; (B) R ; (C) P ; (D) Q

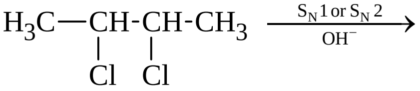
Q.34 (A) S, (B) Q,S (C) R,S (D) P

Q.35 (A) P,Q, (B) S (C) S, (D) P,Q

NUMERICAL VALUE BASES

Q.1 [4]

Q.2

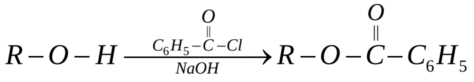


$H_3C-\underset{Cl}{CH}-\underset{Cl}{CH}-CH_3 \xrightarrow[OH^-]{S_N1 \text{ or } S_N2}$

What is the total number of stereo isomers possible.
3

Q.3 [4]

Q.4 [3]

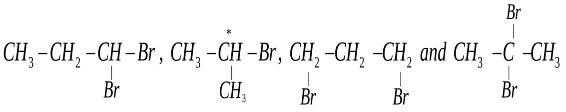


$$R-O-H \xrightarrow[NaOH]{C_6H_5-\overset{O}{\overset{\|}{C}}-Cl} R-O-\overset{O}{\overset{\|}{C}}-C_6H_5$$

i.e. H (Mol. Wt. = 1) is replaced by $-\overset{O}{\overset{\|}{C}}-C_6H_5$ group (mol. Wt. = 105) i.e.,
there is ncreases to 104 in mol. Wt. per OH group.

$$\therefore \text{ No. of OH groups} = \frac{404-92}{104} = \frac{312}{104} = 3$$

Q.5 [5]
There are five products formed

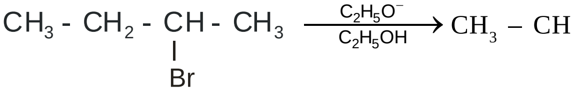


$CH_3-CH_2-\underset{Br}{CH}-Br$, $CH_3-\overset{*}{\underset{CH_3}{CH}}-Br$, $\underset{Br}{CH_2}-CH_2-\underset{Br}{CH_2}$ and $CH_3-\overset{Br}{\underset{Br}{C}}-CH_3$

(d and 1)

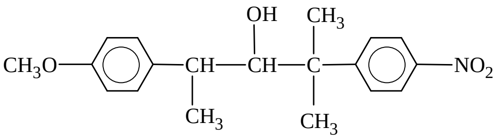
Q.6 [3]

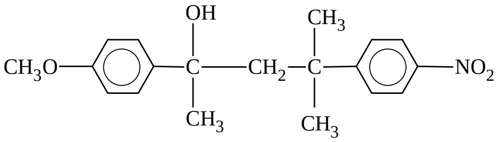
Q.7 [2]

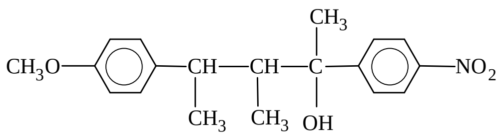


$CH_3-CH_2-\underset{Br}{CH}-CH_3 \xrightarrow[C_2H_5OH]{C_2H_5O^-} CH_3-CH$
$= CH-CH_3 + CH_3-CH_2-CH=CH_2$

Q.8 [3]



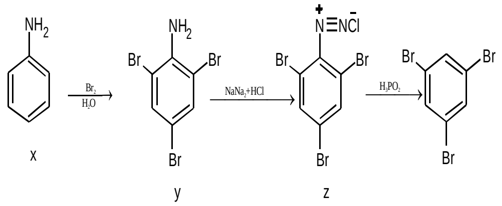




Q.9 [1]

Q.10 [3]
Halogens attached to sp^2 hybridised carbon cannot undergo nucleophilic substitution. Even the bridge-head halogen cannot be substituted.

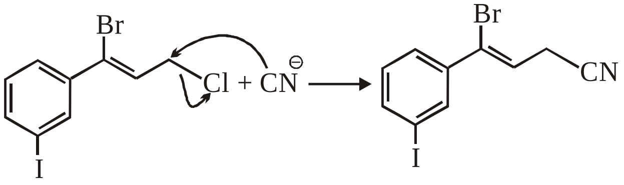
Q.11 [6]



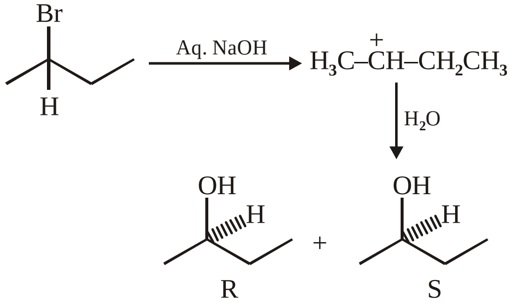
KVPY

PREVIOUS YEAR'S

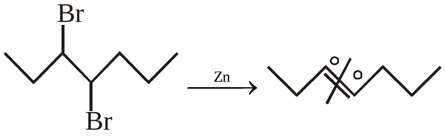
Q.1 (C)
Given reaction → SN^2



Q.2 (3)

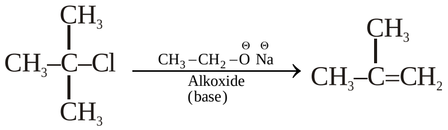


Q.3 (C)



$$\xrightarrow{O_3|Zn, H_2O} 2CH_3CH_2-CHO$$

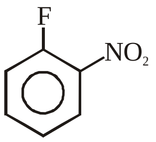
Q.4 (B)



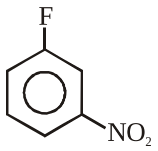
3º (halide)

Alkoxide ion is strong nucleophile and strong base & with 3º Alkyl halide Alkenes is the major product [E_2 Elimination]

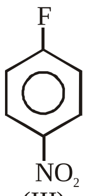
Q.5 **(C)**



(I)



(II)

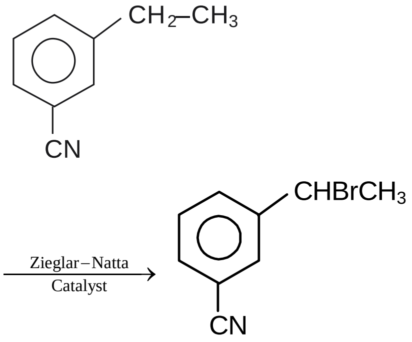


(III)

I and II can react with NaOH but II do not react at room temperature. I and III give reaction because at O and P position electrone withdrawing group is present.

JEE MAINS PREVIOUS YEAR'S

Q.1 (2)



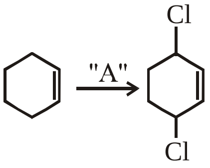
It is free-radical substitution reaction of alkanes, so bromination takes place at benzylic carbon.

Q.2(2)

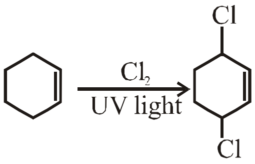
Q.3 (4)

Rate of aromatic nucleophilic substitution reaction depends upon type of halogens and electronic effect of the group present on the ring. Electron withdrawing groups (–I, –M) increases rate of reaction increases.

Q.4 **(3)**



For substitution at allylic position in the given compound, the reagent used is Cl_2/uv light. The reaction is free radical halogenation.



Q.5 **(3)**

Q.6 (4)

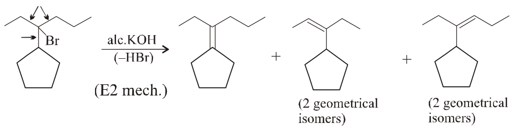
Q.7 (2)

Q.8 (3)

Q.9 (1)

JEE-ADVANCED PREVIOUS YEAR'S

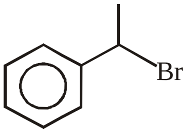
Q.1 [5]



[Number of alkenes formed = 5]

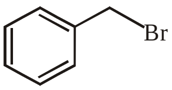
Q.2 (A,C,D)

(A) compound

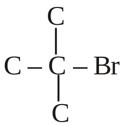


,2° benzylic may follow path SN_1 and SN_2.

(C) I is



(1° benzylic halide) and

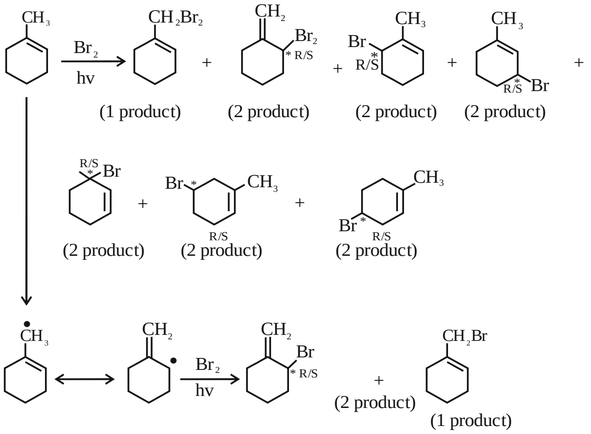


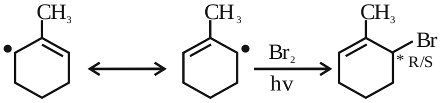
$$C-\overset{\displaystyle C}{\underset{\displaystyle C}{C}}-Br$$

(3° alkyl halide). Follow SN_1

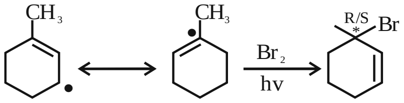
(D) I and II follow SN_2 also, as both are 1° halide

Q.3 [13]

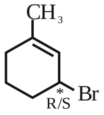




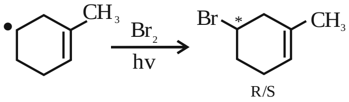
(same as already
mentioned above
as one the product)



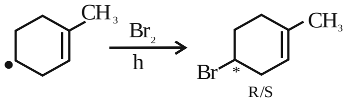
(2 product) +



(2 product)



(2 product)



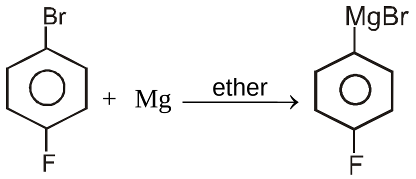
(2 product)

Grignard Reagent

EXERCISES

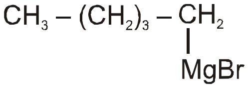
JEE-MAIN
OBJECTIVE QUESTIONS

Q.1 (B)



Flourine will not form G.R.

Q.2 (A)



$CH_3-(CH_2)_3-CH_2-MgBr$

$CH_3-(CH_2)_5\,CH_2\,OH$

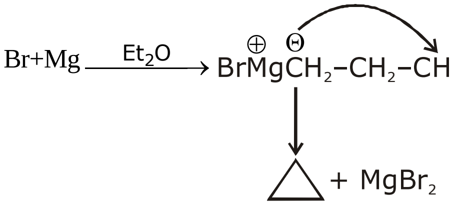
$CH_3-(CH_2)_5\,CH_2\,Br$

(A) (B)

(C)

Q.3 (C)

$Br-CH_2-CH_2-CH_2-$



Q.4 (A)

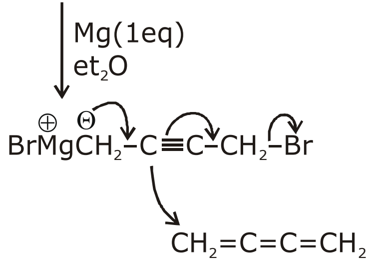
Reactivity of Alkyl halide for

$R-X+mg \longrightarrow RMgx$

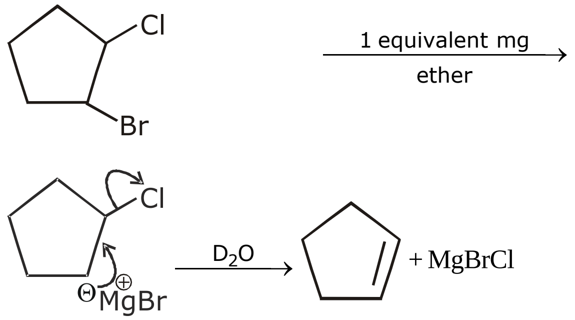
$\Rightarrow$ (R–I > R –Br >R–Cl)

Q.5 (D)

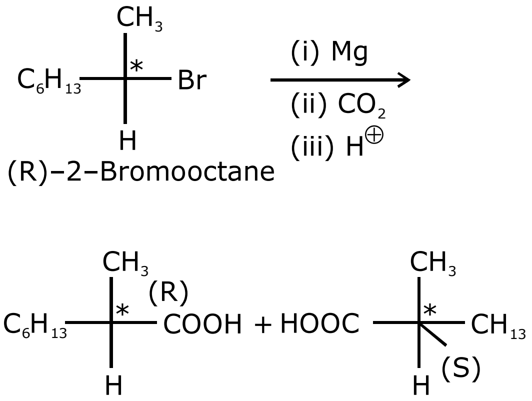
$Br-CH_2-C\equiv C-CH_2-Br \xrightarrow[\text{(excess)}\ Et_2O]{Mg} BrMgCH_2-C\equiv C-CH_2MgBr$



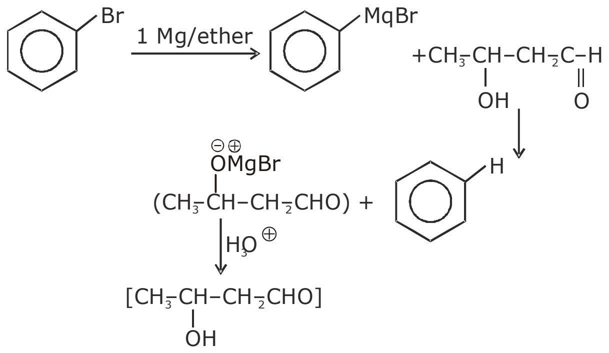
Q.6 (D)



Q.7 (C)

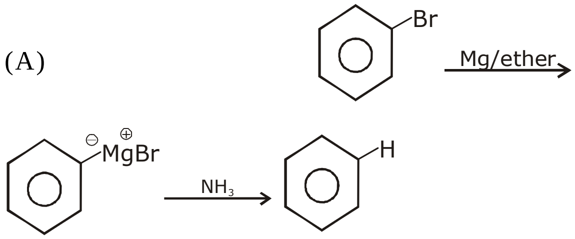


Q.8 (C)

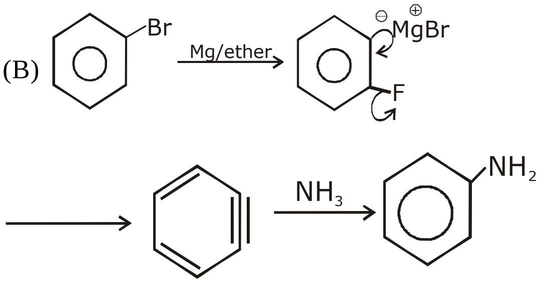


Q.9 (B)

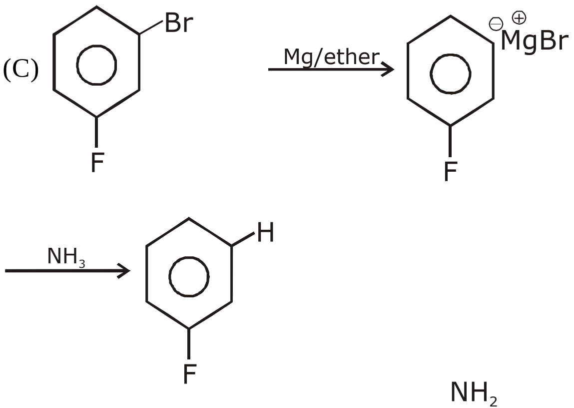
(A)



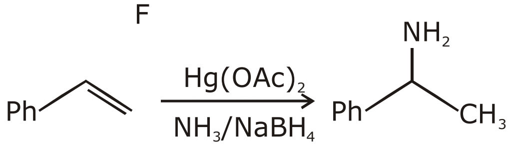
(B)



(C)



(D)



Q.10 (D)

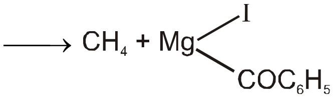
decreasing order of ionic character in following organo metallic compond

$CH_3–Li > (CH_3)_2\,Mg > (CH_3)_2\,Zn > (CH_3)_2Hg$

[ionic character $\propto$ difference between E.N.]

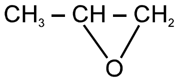
Q.11 (C)

(A) C_6H_5COOH + CH_3MgI

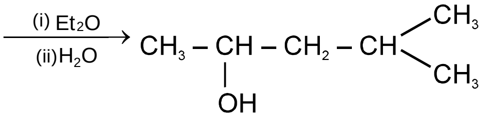


Q.12 (C)

(C)



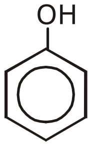
\+ $(CH_3)_2CH$ Mg Br



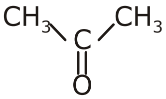
Q.13 (C)

$C_6H_5–COOH + CH_3MgI \rightarrow CH_4 + C_6H_5COOMgI$

Q.14 (A)



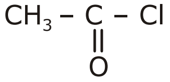
(I)



(II)

$CH_3–Cl$

(III)



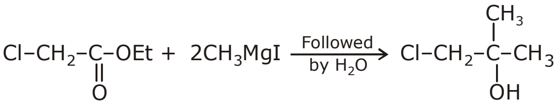
$CH_3–C(=O)–Cl$

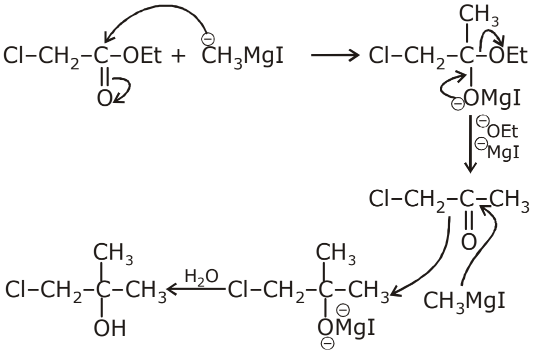
(IV)

reactivity order of CH_3MgBr with following compound.

I > IV > II > III

Q.15 (D)





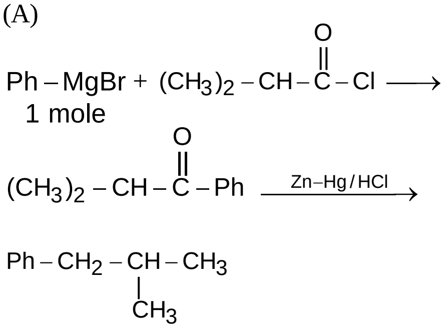
Q.16 (A)

$(CH_3)_3\,CMgCl + D_2O \longrightarrow (CH_3)_3CD$

Q.17 (C)

R– Br is $CH_3 – CH_2 – Br$ which undergoes in Wurtz reaction to give the products $CH_3 – CH_2 – CH_2 – CH_3$ and $CH_3 – CH_3$

Q.18 (A)

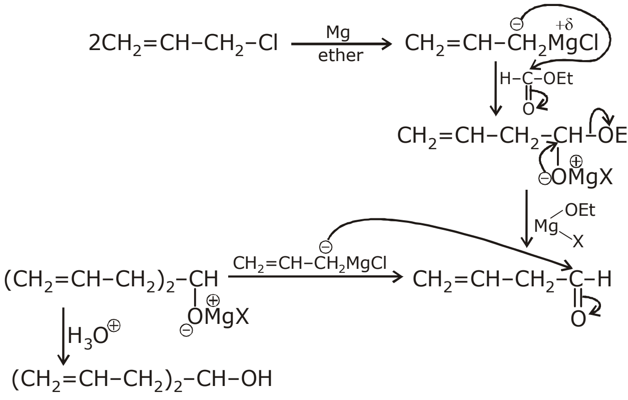


$Ph – MgBr + (CH_3)_2 – CH – C(=O) – Cl \longrightarrow$
1 mole

$(CH_3)_2 – CH – C(=O) – Ph \xrightarrow{Zn–Hg/HCl}$

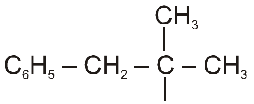
$Ph – CH_2 – CH(CH_3) – CH_3$

Q.19 (A)



Q.20 (B)

$C_6H_5 - CH_2CO_2CH_3 \xrightarrow[2.\ H^+]{1.\ CH_3MgBr\ (excess)}$



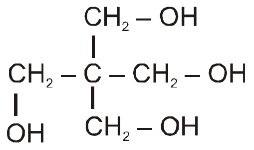
$C_6H_5-CH_2-\overset{CH_3}{\overset{|}{\underset{OH}{\underset{|}{C}}}}-CH_3$

(Major product)
t-alcohol

Q.21 (C)

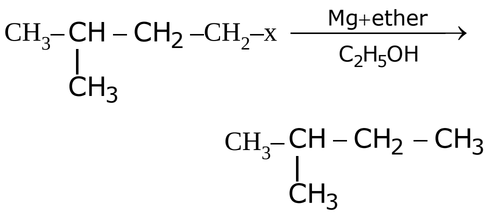
$C_5H_{12}O_4 \xrightarrow{CH_3MgBr} 4CH_4\uparrow.$

It means compound (A) contains 4 acidic hydrogen.

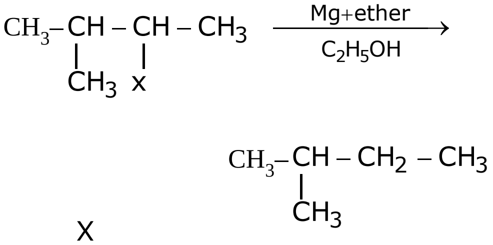


$\underset{OH}{\underset{|}{CH_2}}-\overset{CH_2-OH}{\overset{|}{\underset{CH_2-OH}{\underset{|}{C}}}}-CH_2-OH$

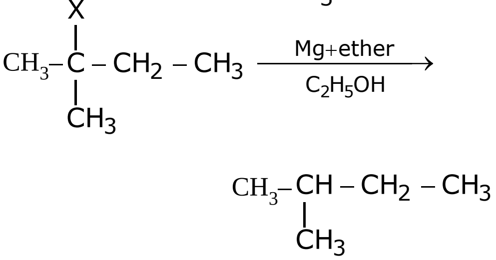
Q.22 (C)

(1) 

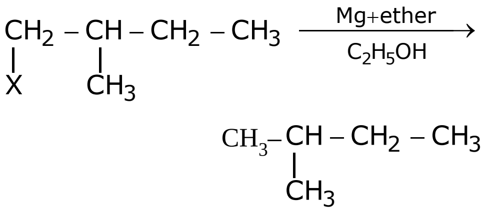
$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_2-X \xrightarrow[C_2H_5OH]{Mg+ether} CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_3$

(2) 

$CH_3-\underset{CH_3}{\underset{|}{CH}}-\underset{X}{\underset{|}{CH}}-CH_3 \xrightarrow[C_2H_5OH]{Mg+ether} CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_3$

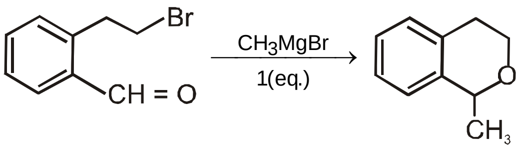
(3) 

$CH_3-\overset{X}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-CH_2-CH_3 \xrightarrow[C_2H_5OH]{Mg+ether} CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_3$

(4) 

$\underset{X}{\underset{|}{CH_2}}-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_3 \xrightarrow[C_2H_5OH]{Mg+ether} CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_3$

Q.23 (A)



Q.24 (C)

$CH_3MgBr + \underset{(excess)}{C_4H_9NH_2} \longrightarrow$

$CH_4 + C_4H_9\overset{\ominus}{N}H\overset{\oplus}{M}gBr$

$\frac{.595\,gram}{119} \Rightarrow .05 \qquad .05\text{ mole} \qquad .05\text{ mole}$

$CH_4\text{ (in liter)} \Rightarrow .05 \times 22.4 \Rightarrow .112\text{ liter}$

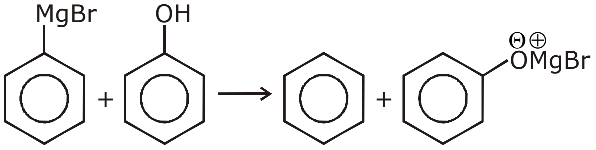
Q.25 (C)

$CH_2 = \underset{2\text{ mole}}{\overset{\ominus}{C}H\overset{\oplus}{M}gBr} + \underset{1\text{ mole}}{CH \equiv CH} \longrightarrow \underset{2\text{ mole}}{CH_2 = CH_2}$

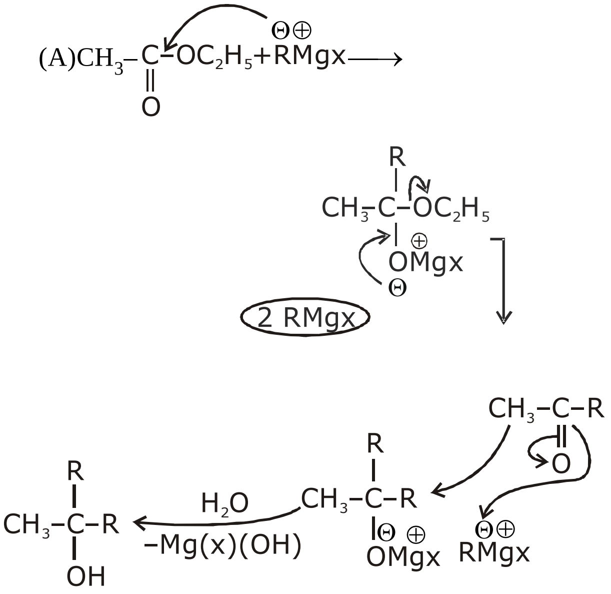
$\frac{2.62}{131} = .02 \qquad \frac{224\text{ ml}}{22400} = .01 \qquad .02$

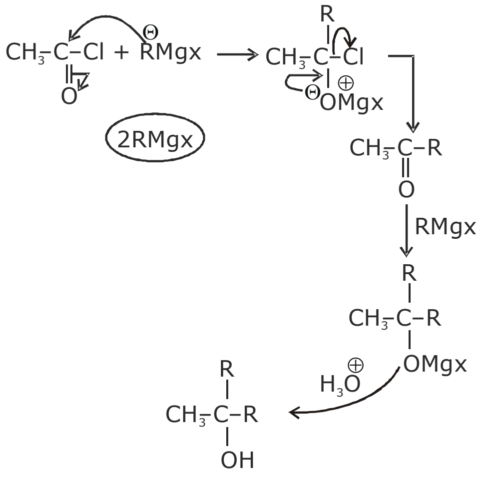
$CH_2{=}CH_2\text{ (in liter)} \Rightarrow .02 \times 22.4 \Rightarrow 0.448\text{ liter}$

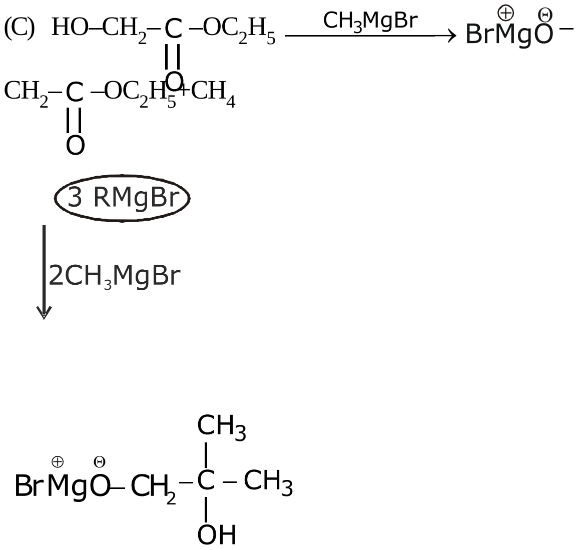
Q.26 (A)



Q.27 (A)

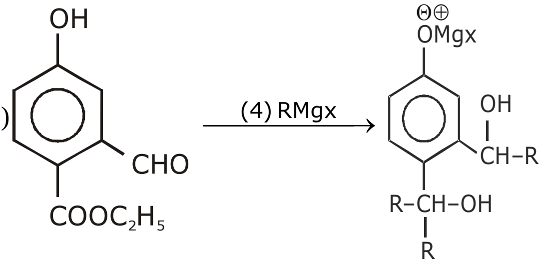


(B)


(C)


$$HO-CH_2-\underset{\overset{\|}{O}}{C}-OC_2H_5 \xrightarrow{CH_3MgBr} \overset{\oplus}{Br}\overset{\ominus}{MgO}-CH_2-\underset{\overset{\|}{O}}{C}-OC_2H_5+CH_4$$

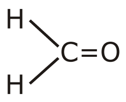
$$\overset{\oplus}{Br}Mg\overset{\ominus}{O}-CH_2-\underset{OH}{\overset{CH_3}{C}}-CH_3$$

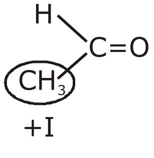
(D)


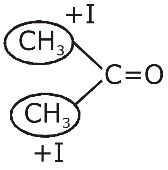
Q.28 (A)

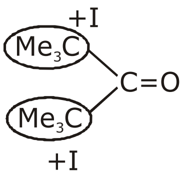
(I > II > III > IV)

Reactivity order of following carbonyl comp. with G.R.

(i)


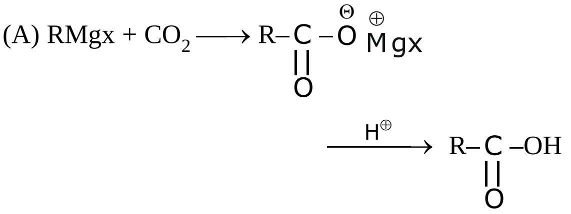
(ii)


(iii)


(iv)


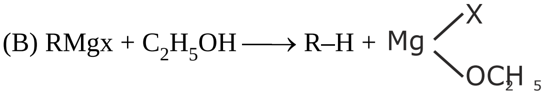
More ⊕ve charge at carbon in $-\underset{\overset{\|}{O}}{C}-$ bond will be more reactive for G.R.

Q.29 (C)

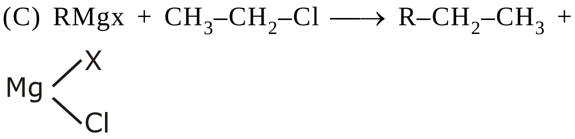


(A) $RMgx + CO_2 \longrightarrow R-\underset{\overset{\|}{O}}{C}-\overset{\ominus}{O}\,\overset{\oplus}{M}gx$

$\xrightarrow{H^{\oplus}} R-\underset{\overset{\|}{O}}{C}-OH$



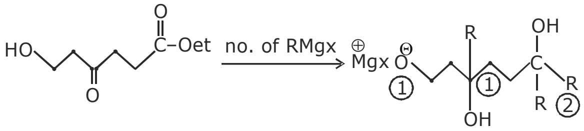
(B) $RMgx + C_2H_5OH \longrightarrow R-H + Mg\begin{matrix}X\\OC_2H_5\end{matrix}$



(C) $RMgx + CH_3-CH_2-Cl \longrightarrow R-CH_2-CH_3 + Mg\begin{matrix}X\\Cl\end{matrix}$

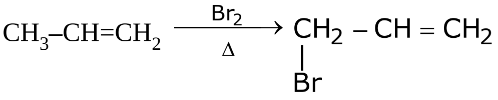
(D) RMgx +

Q.30 (A)

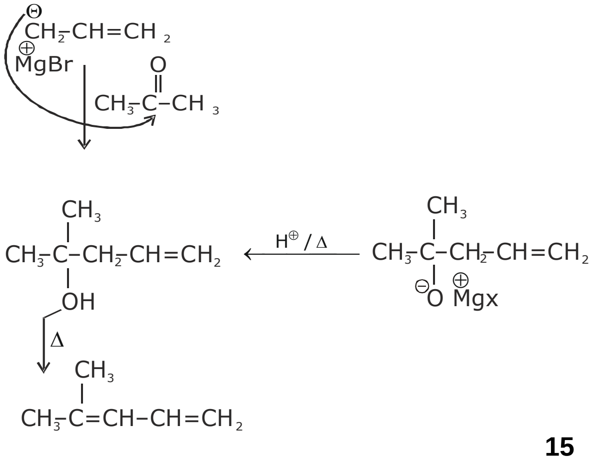


⇒ no. of G.R. (RMgx) consumed per mole compound = (4)

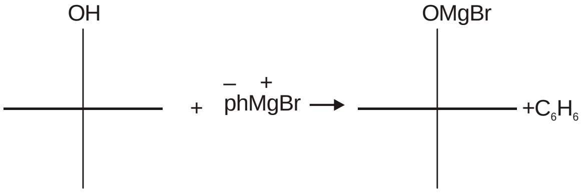
Q.31 (B)



$$CH_3-CH=CH_2 \xrightarrow[\Delta]{Br_2} \underset{Br}{CH_2}-CH=CH_2$$



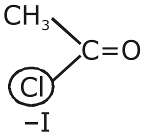
Q.32 C



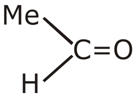
Q.33 (A)

Reactivity order of following with PhMgBr

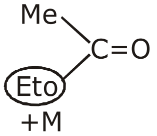
(I)



(ii)



(iii)

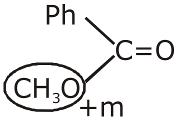


$\boxed{I > II > III}$

Q.34 (C)

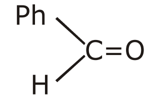
Decreasing reactivity order of following comp. toward attack of G.R.

(i)



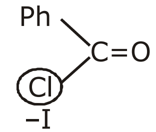
Methyl benzoate

(ii)



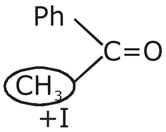
Benzaldehyde

(iii)



Benzoyl chloride

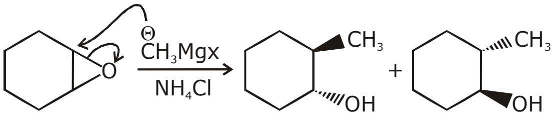
(iv)



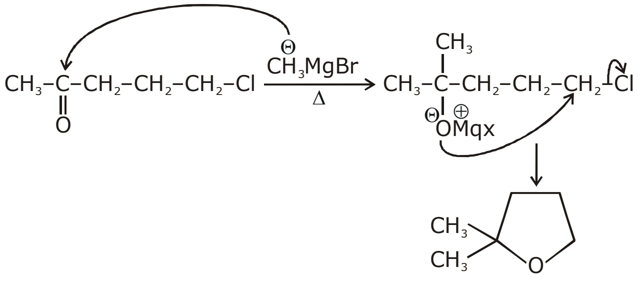
Acetopheno

$\boxed{III > II > IV > I}$

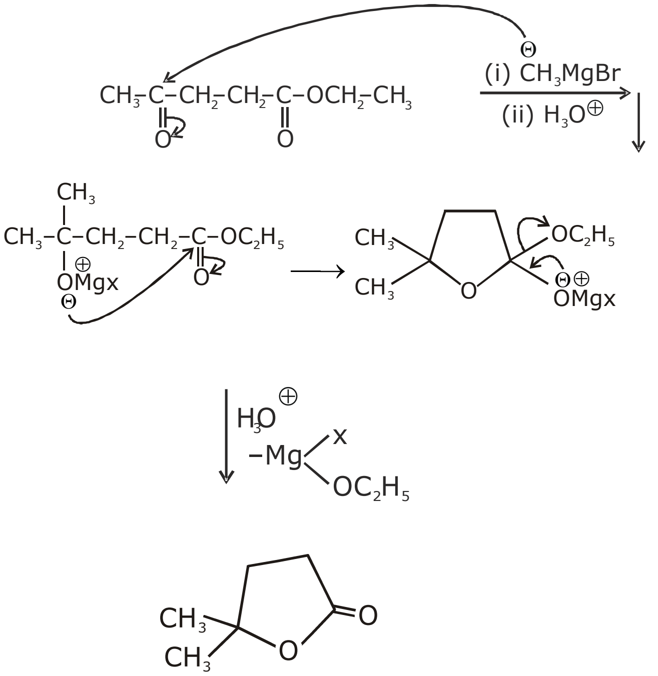
Q.35 (A)



Q.36 (C)



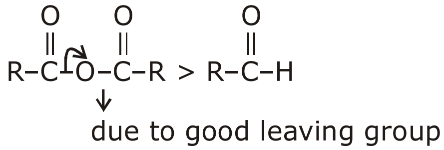
Q.37 (C)



Q.38 (B)

(Reactivity order towards G.R. for Nu$^{\Theta}$ attack)

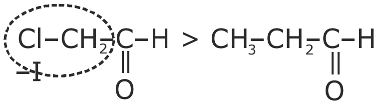
(A)



$R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R > R-\overset{O}{\overset{\|}{C}}-H$

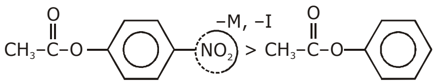
due to good leaving group

(B)

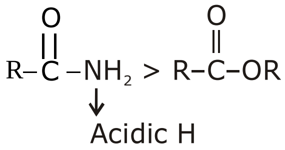


$Cl-CH_2-\underset{O}{\underset{\|}{C}}-H > CH_3-CH_2-\underset{O}{\underset{\|}{C}}-H$

(C)



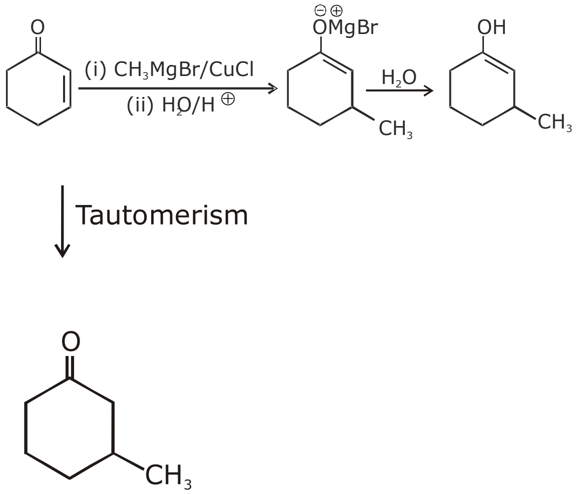
(D)



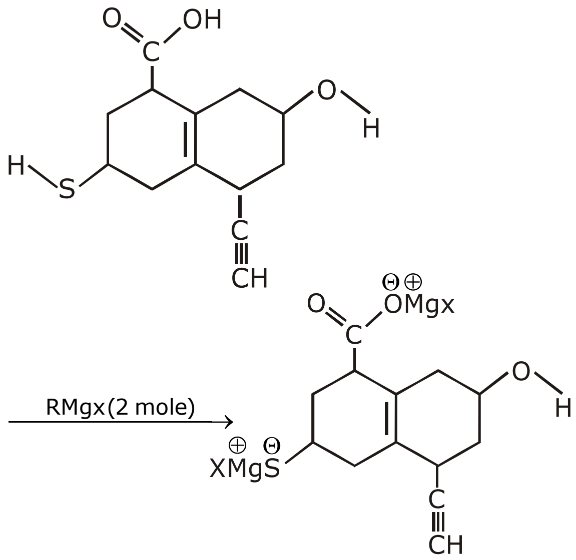
$R-\overset{O}{\overset{\|}{C}}-NH_2 > R-\overset{O}{\overset{\|}{C}}-OR$

Acidic H

Q.39 (B)

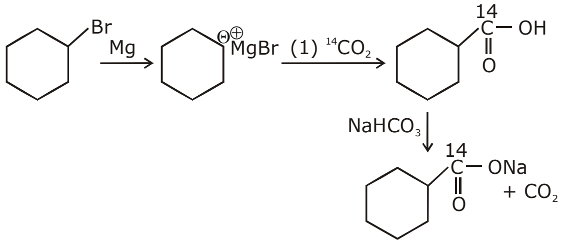


Q.40 (A)



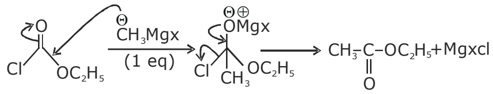
More Acidic H react with R Mgx and gives Alkane.

Q.41 (A)

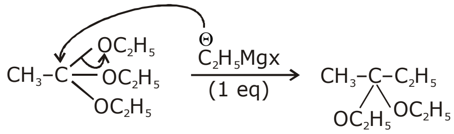


Q.42 (B)

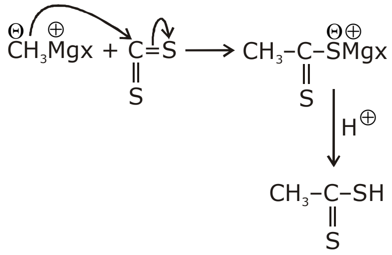
(A)



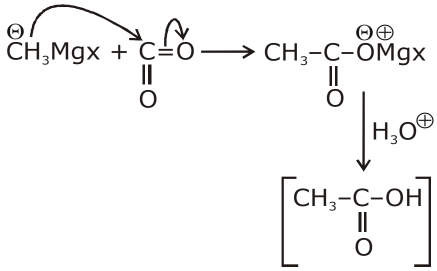
(B)



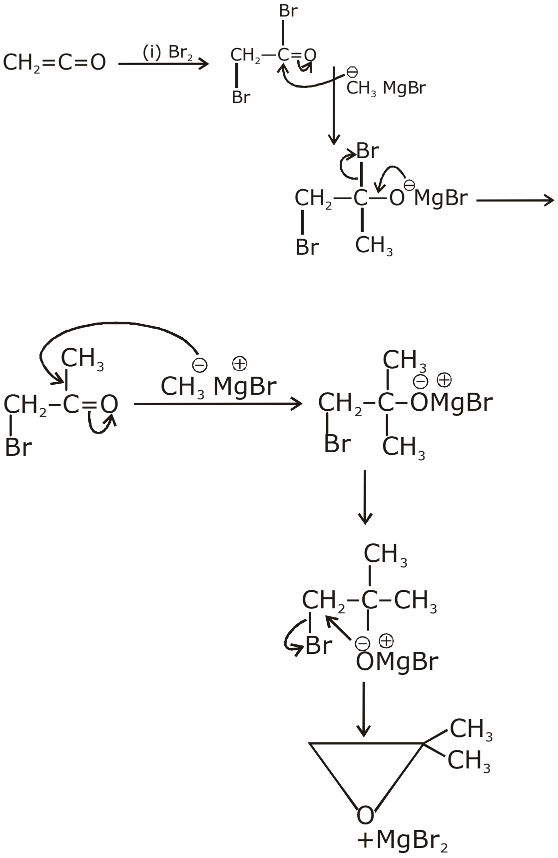
(C)



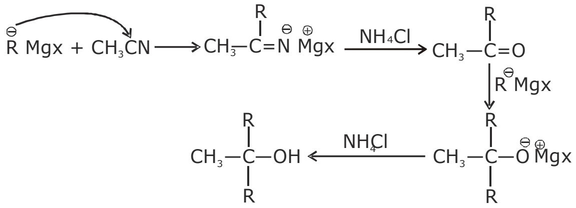
(D)



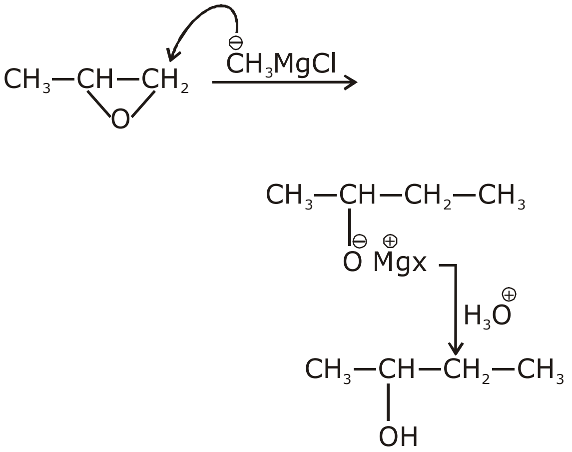
Q.43 (A)



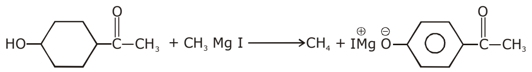
Q.44 (C)



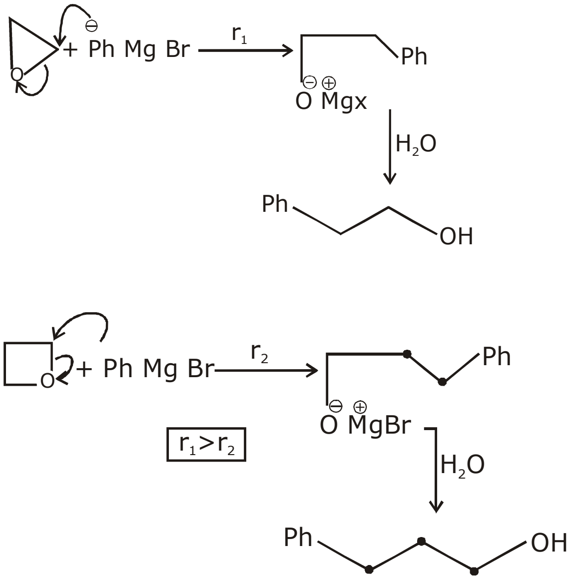
Q.45 (B)



Q.46 (A)

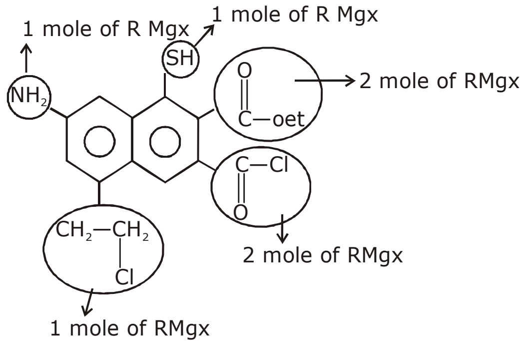


Q.47 (B)



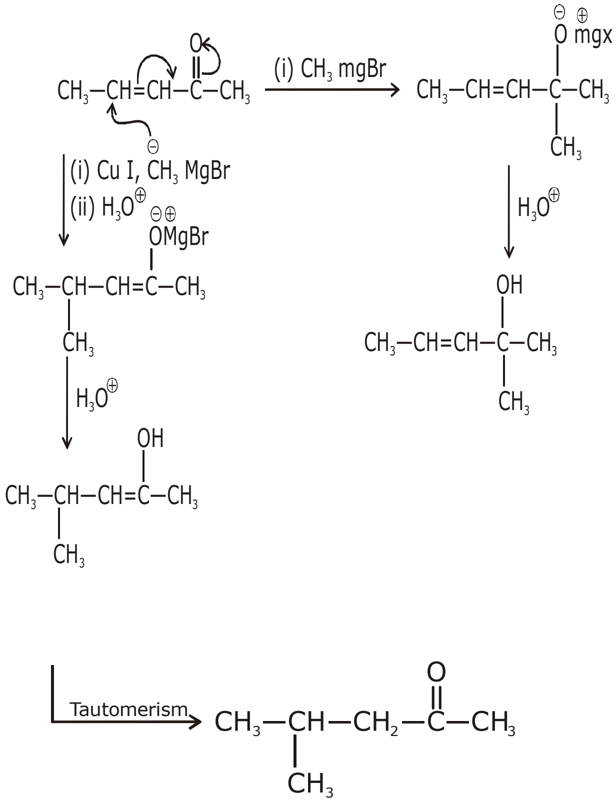
3 Membred ring having more angle strain than 4 membred ring

Q.48 (A)



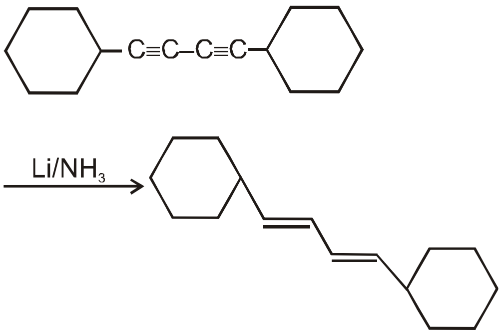
Total No. of R Mgx consumed in above comp = 7

Q.49 (C)



Q.50 (D)
cis-alkene formed by lindlar catalyst and trans - alkene formed by Na/NH_3

Q.51 (B)



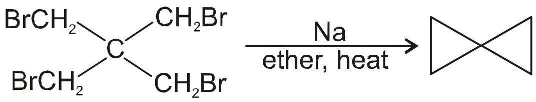
Q.52 (B)
It is birch reduction

Q.53 (A)
It is birch reduction

Q.54 (D)
X can be H_2 / Ni and $LiAlH_4$

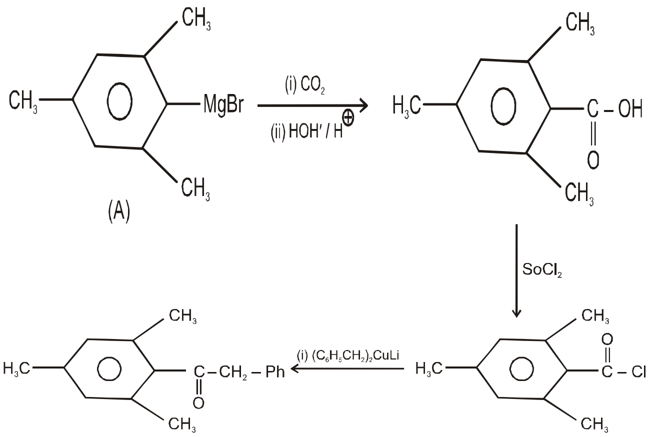
Q.55 (D)
All reaction are correct.

Q.56 (D)

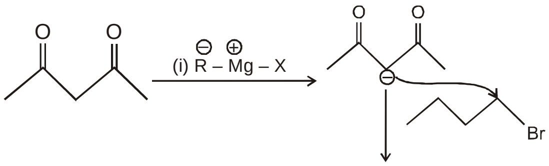


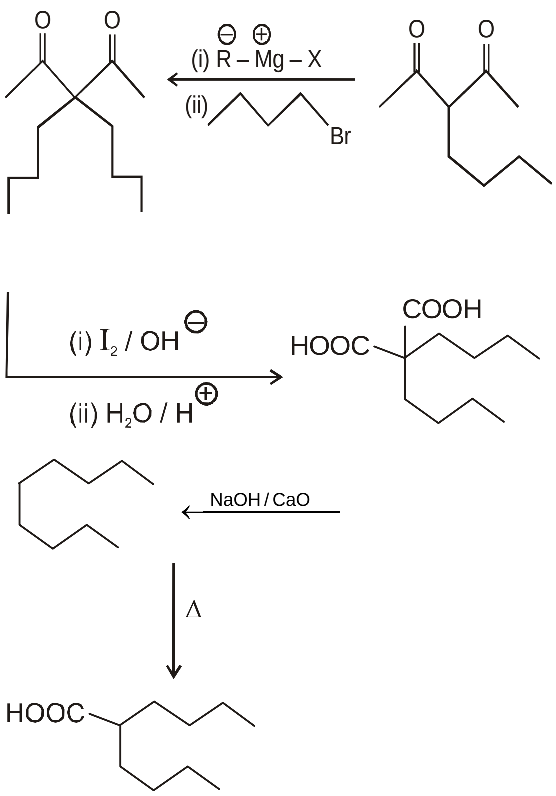
JEE-ADVANCED OBJECTIVE QUESTIONS

Q.1 (A)

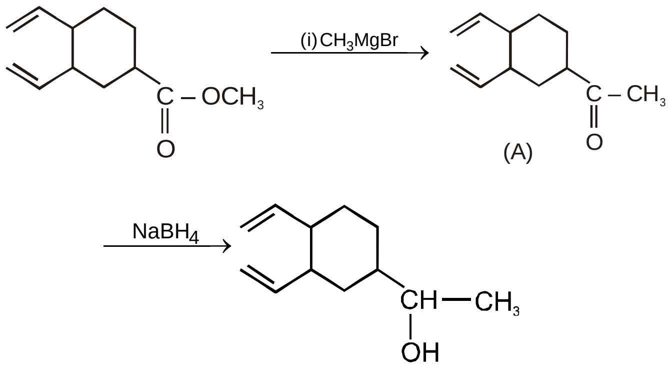


Q.2 (A)

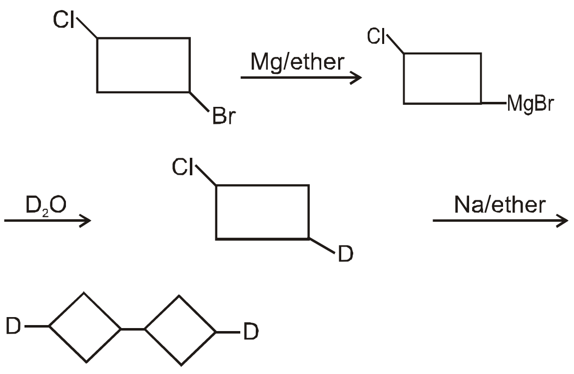




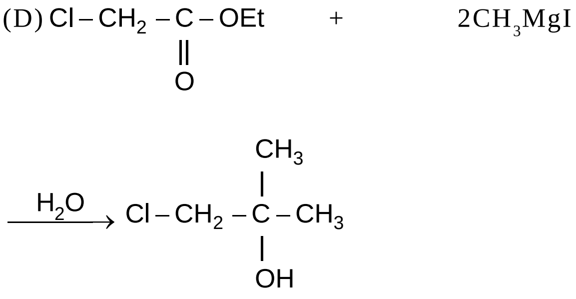
Q.3(C)



Q.4 (B)



Q.5 (D)

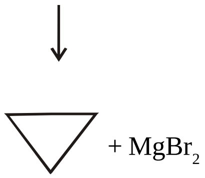


$$\text{(D) } \mathrm{Cl-CH_2-\underset{O}{\underset{\|}{C}}-OEt} + 2CH_3MgI \xrightarrow{H_2O} \mathrm{Cl-CH_2-\underset{OH}{\overset{CH_3}{C}}-CH_3}$$

Q.6 (C)

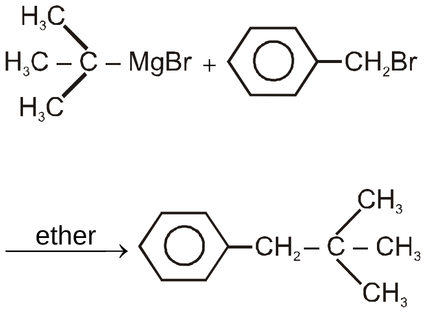
$BrCH_2CH_2CH_2Br + Mg$

$\xrightarrow{Et_2O} Br-CH_2-CH_2-CH_2\,MgBr$

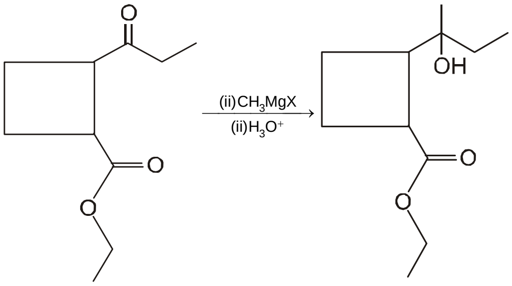


+ $MgBr_2$

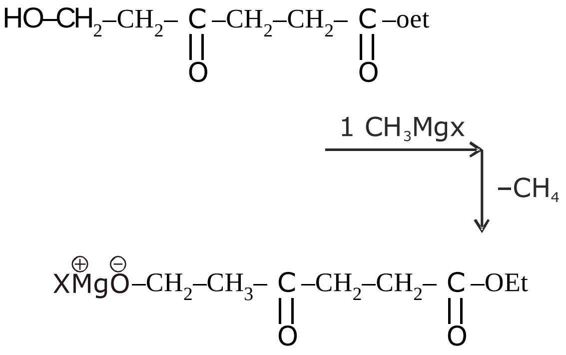
Q.7 (C)



Q.8 (A)

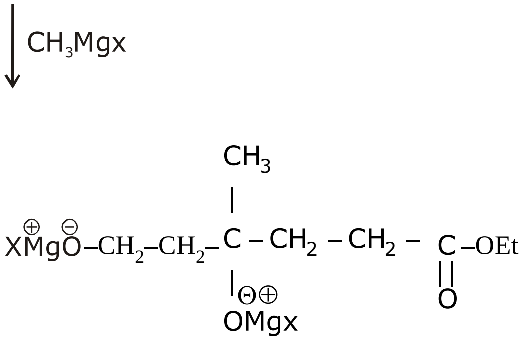


Q.9 (B)



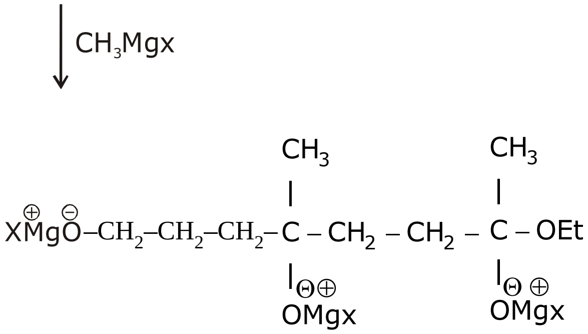
$$\mathrm{HO-CH_2-CH_2-\underset{O}{\underset{\|}{C}}-CH_2-CH_2-\underset{O}{\underset{\|}{C}}-oet} \xrightarrow[-CH_4]{1\ CH_3Mgx} \mathrm{X\overset{\oplus}{Mg}\overset{\ominus}{O}-CH_2-CH_3-\underset{O}{\underset{\|}{C}}-CH_2-CH_2-\underset{O}{\underset{\|}{C}}-OEt}$$

(P)



$$\xrightarrow{CH_3Mgx} \mathrm{X\overset{\oplus}{Mg}\overset{\ominus}{O}-CH_2-CH_2-\underset{\overset{\ominus\oplus}{O}Mgx}{\overset{CH_3}{C}}-CH_2-CH_2-\underset{O}{\underset{\|}{C}}-OEt}$$

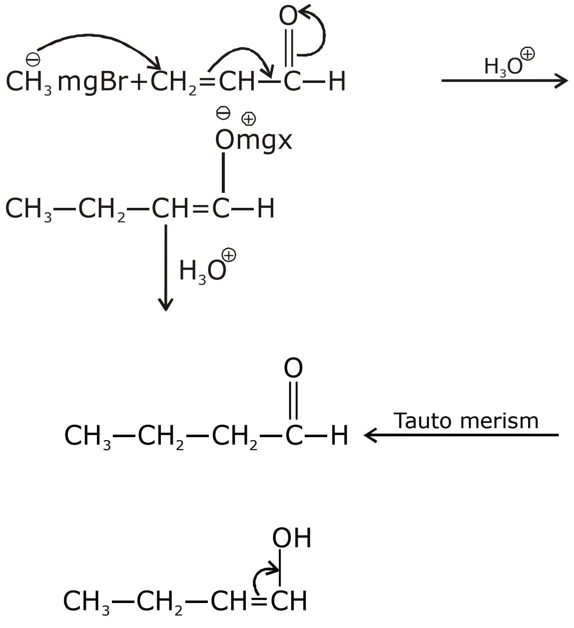
(Q)



$$\xrightarrow{CH_3Mgx} \mathrm{X\overset{\oplus}{Mg}\overset{\ominus}{O}-CH_2-CH_2-CH_2-\underset{\overset{\ominus\oplus}{O}Mgx}{\overset{CH_3}{C}}-CH_2-CH_2-\underset{\overset{\ominus\oplus}{O}Mgx}{\overset{CH_3}{C}}-OEt}$$

(R)

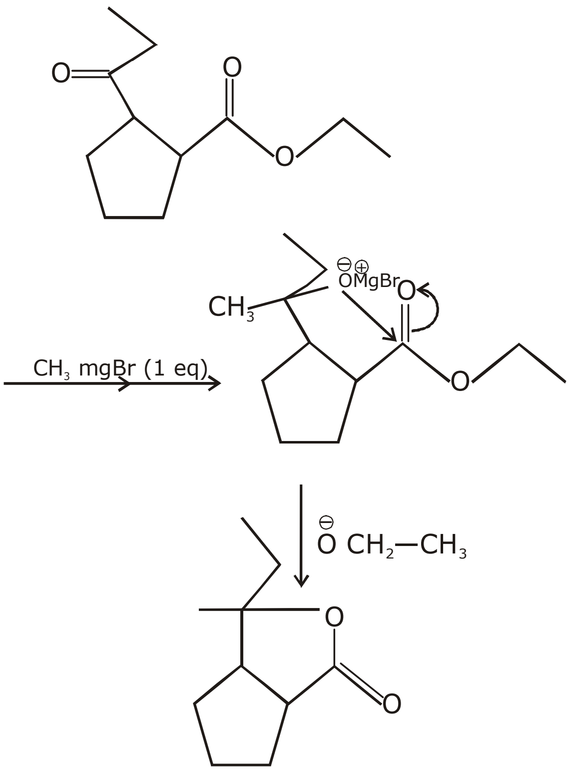
Q.10 (C)



$$\mathrm{\overset{\ominus}{C}H_3\,mgBr + CH_2{=}CH-\overset{O}{\overset{\|}{C}}-H \xrightarrow{H_3O^{\oplus}}}$$

$$\mathrm{CH_3-CH_2-CH{=}\overset{\overset{\ominus\ \oplus}{O}mgx}{C}-H \xrightarrow{H_3O^{\oplus}} CH_3-CH_2-CH{=}\overset{OH}{CH} \xrightarrow{\text{Tauto merism}} CH_3-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-H}$$

Q.11 (D)



JEE-ADVANCED

MCQ/COMPREHENSION/COLUMN MATCHING

Q.1 **(AB)**

R is $CH_3-CH_2-CH_2-CH_2$ or $CH_3-\underset{|}{CH}-CH_2-CH_3$

Q.2 **(AD)**

$CH_3CH_2Cl \xrightarrow{Li} CH_3CH_2Li \xrightarrow{CuLi} 2CH_3CH_2$

$Li + CuI \longrightarrow (CH_3CH_2)_2CuLi$ (X)

$\Big\downarrow CH_3(CH_2)_5CH_2Br$

$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$

n-nonane

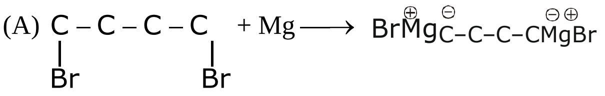
Q.3 **(ABD)**

A, B and D are incorrect Grignard synthesis.

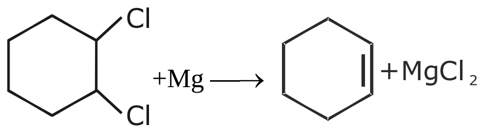
Q.4 **(ABC)**

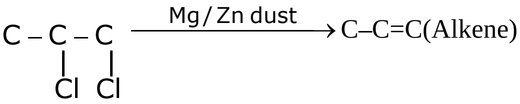
Active hydrogen containing functional group release CH_4 gas with CH_3MgBr.

Q.5 **(A,D)**

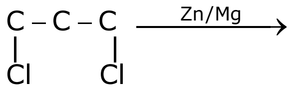
(A) 

$\underset{Br}{C}-C-C-\underset{Br}{C} + Mg \longrightarrow Br\overset{\oplus}{Mg}\overset{\ominus}{C}-C-C-\overset{\ominus}{C}\overset{\oplus}{MgBr}$

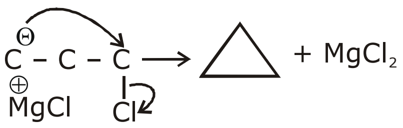
(B) 

(C) 

$C-\underset{Cl}{C}-\underset{Cl}{C} \xrightarrow{Mg/Zn\ dust}$ C–C=C(Alkene)

(D) 

$\underset{Cl}{C}-C-\underset{Cl}{C} \xrightarrow{Zn/Mg}$

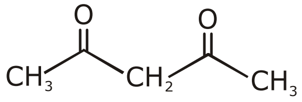


Q.6 **(A,B)**

These comp react with G.R. and gives alkane which have more acidic Hydrogen

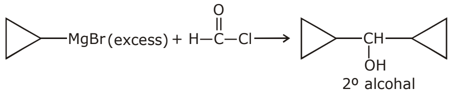
(i) $CH_3-CH_2-NO_2$

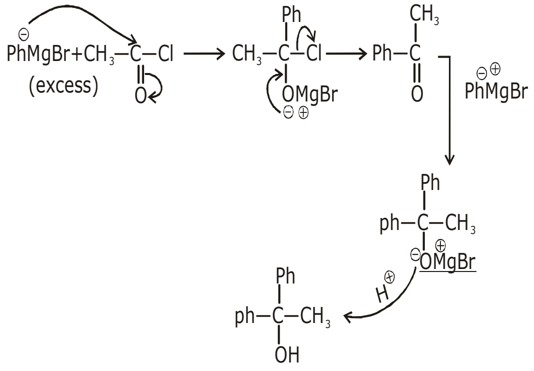
Nitro ethane

(ii) 

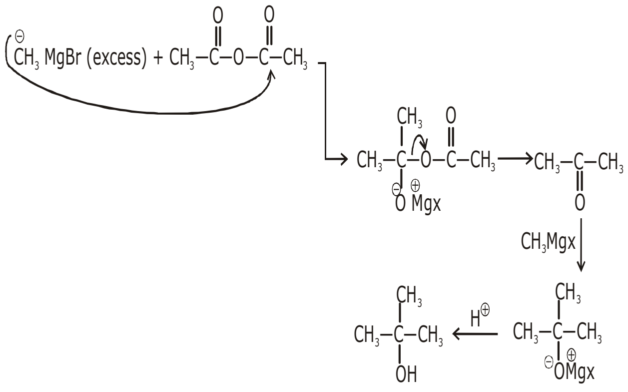
Acetyl Acetone

Q.7 **(B,C,D)**

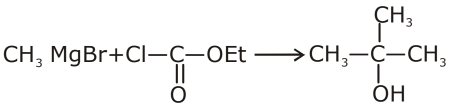
(A) 

(B) 

(C)

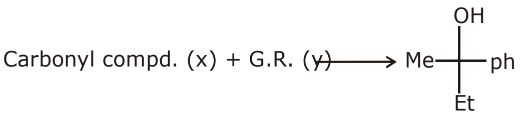


(D)



$$CH_3MgBr + Cl-\underset{\underset{O}{\|}}{C}-OEt \longrightarrow CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$$

Q.8 **(A,B,C)**

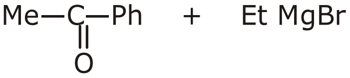


$$\text{Carbonyl compd. (x) + G.R. (y)} \longrightarrow Me-\overset{\overset{OH}{|}}{\underset{\underset{Et}{|}}{C}}-ph$$

(i)

$$Et-\underset{\underset{O}{\|}}{C}-Ph \quad + \quad MeMgBr$$

(ii)

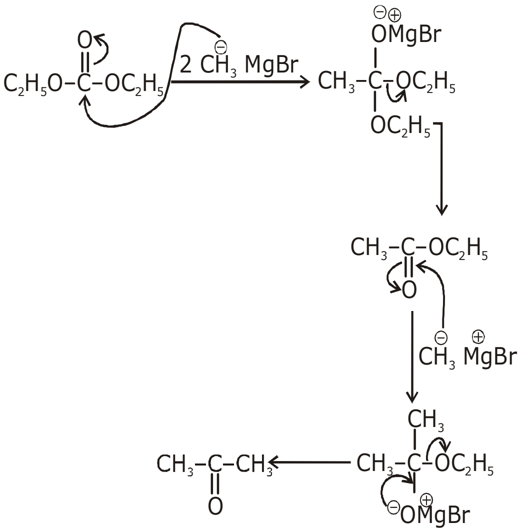


$$Me-\underset{\underset{O}{\|}}{C}-Ph \quad + \quad Et\ MgBr$$

(iii)

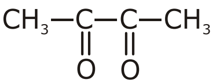
$$Me-\underset{\underset{O}{\|}}{C}-et \quad + \quad Ph\ MgBr$$

Q.9 **(C,D)**



Q.10 **(B,D)**

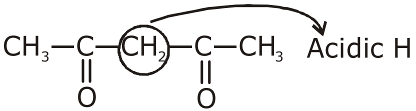
(A)



$$CH_3-\underset{\underset{O}{\|}}{C}-\underset{\underset{O}{\|}}{C}-CH_3$$

Show NAR with G.R

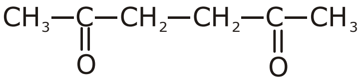
(B)



$$CH_3-\underset{\underset{O}{\|}}{C}-CH_2-\underset{\underset{O}{\|}}{C}-CH_3 \quad \text{Acidic H}$$

react with G.R and give Alkane

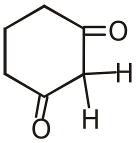
(C)



$$CH_3-\underset{\underset{O}{\|}}{C}-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-CH_3$$

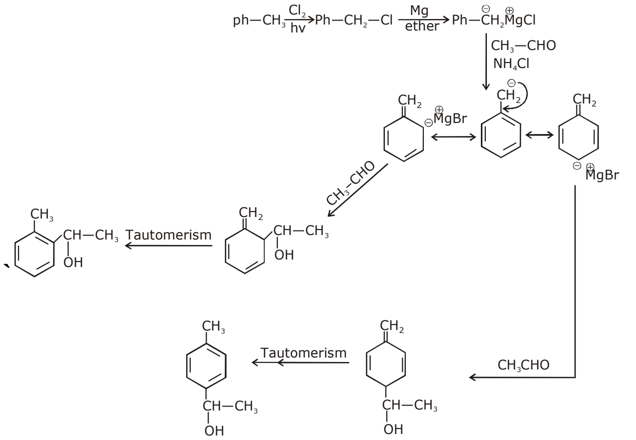
show NAR with GR

(D)

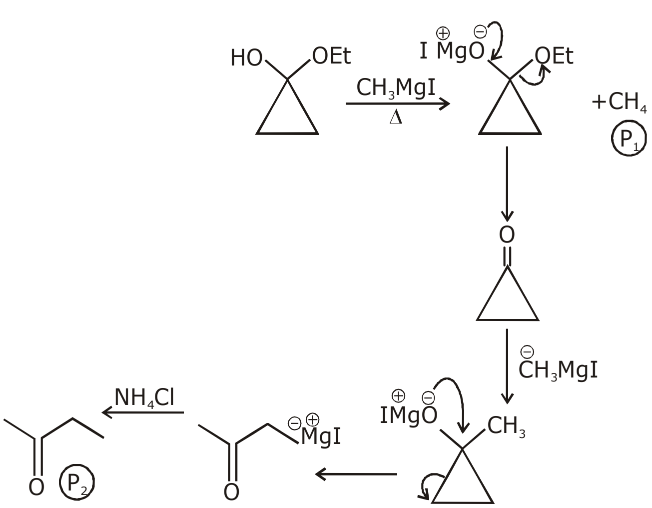


This is acidic H react with G.R. and given alkane

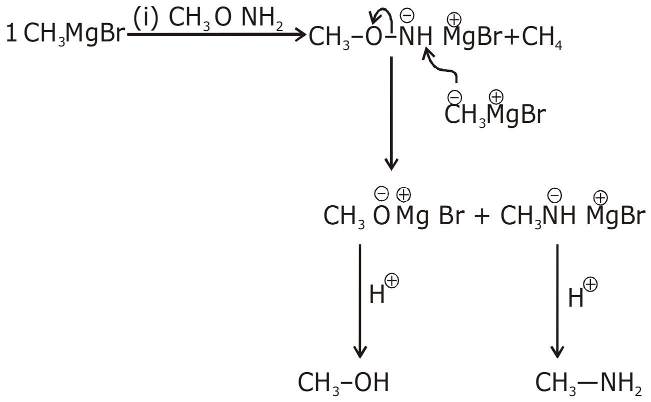
Q.11 **(A,B,C)**



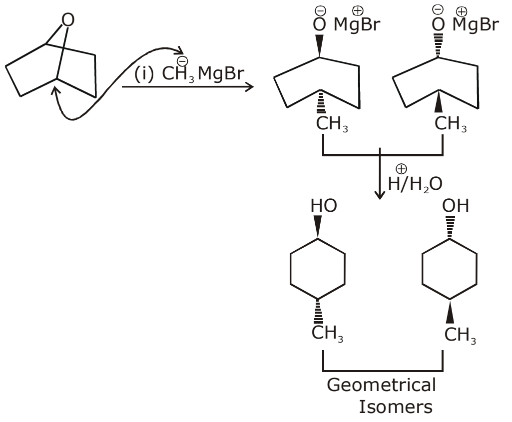
Q.12



Q.13 (C,D)

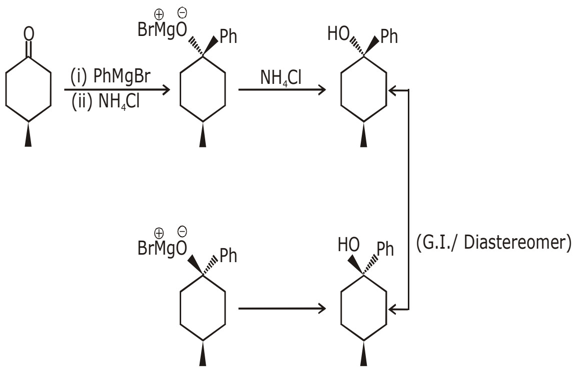


Q.14 (B,C)



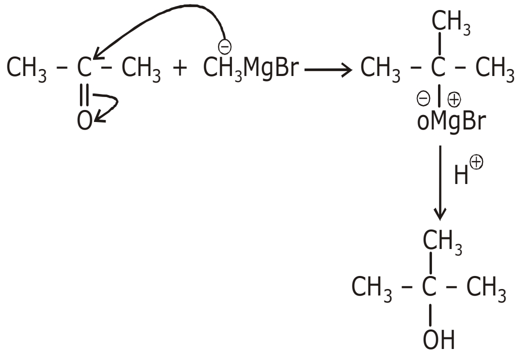
both comp having pos and show geometrical Isomer

Q.15 (A,C,D)

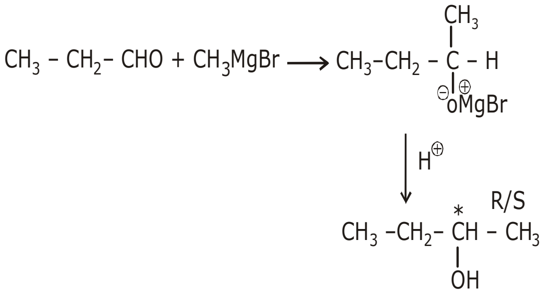


Q.16 (B,C)

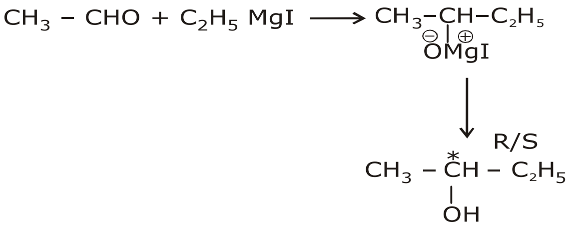
(A)



(B)

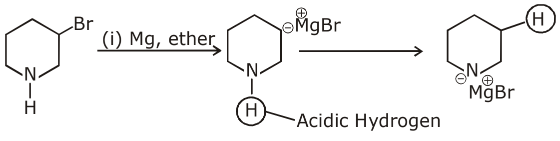


(C)

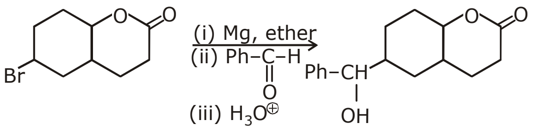


Q.17 (A,B,D)

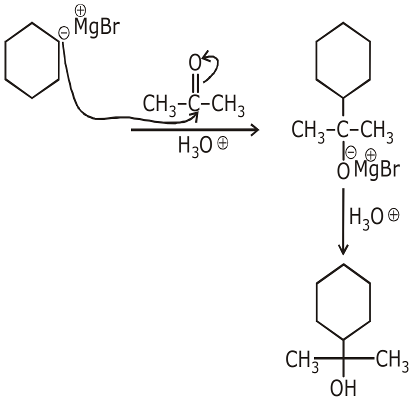
(i)



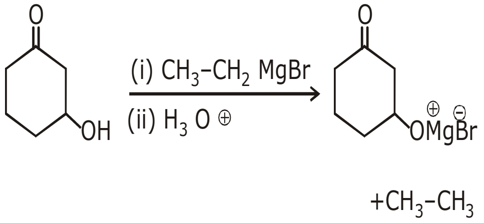
(ii)



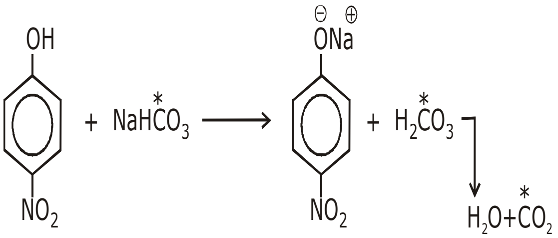
(iii)

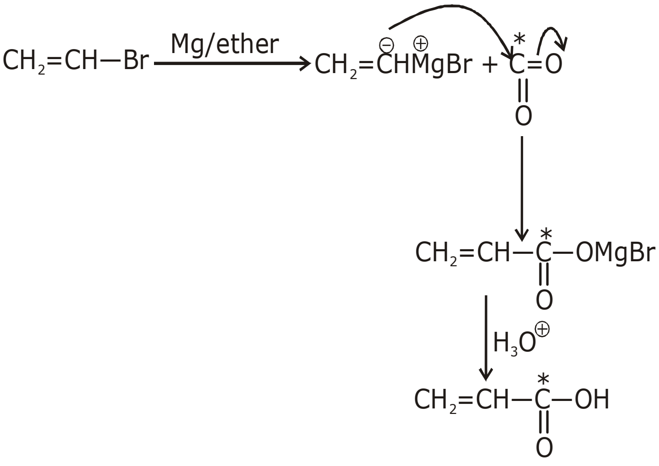


(iv)



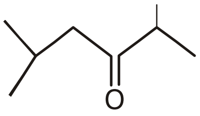
Q.18 (A,B,C)



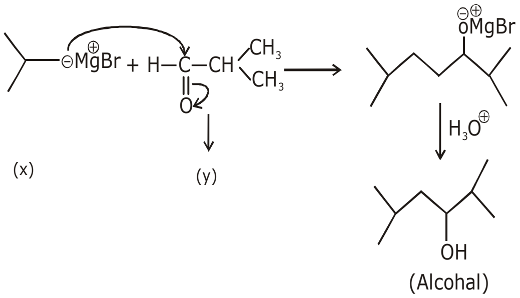


Q.19 (A,B,D)

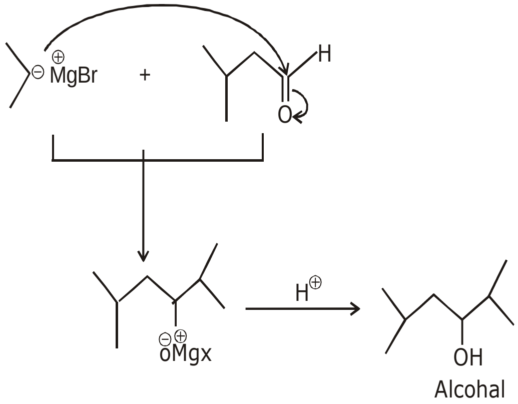
$$X+y \xrightarrow{\text{(i) } Et_2O} \text{Alcohal} \xrightarrow[\text{Acetone}]{H_2CrO_4} \text{ketone}$$



(i)

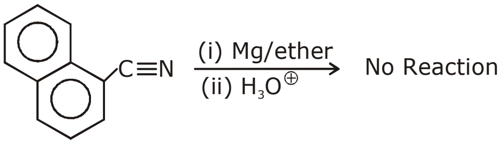


(ii)

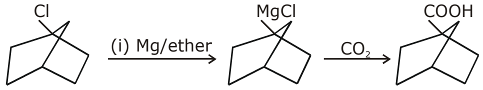


Q.20 (B,D)

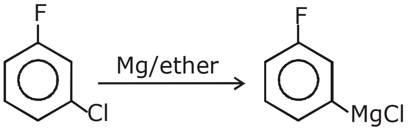
(A)



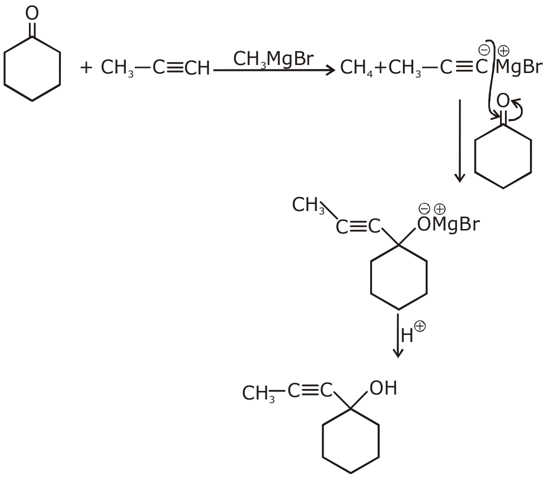
(B)



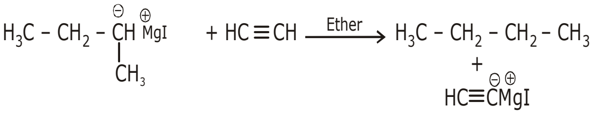
(C)



(D)

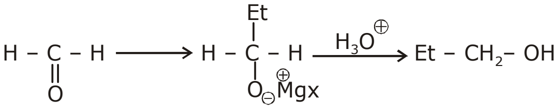


Q.21 **(B,D)**

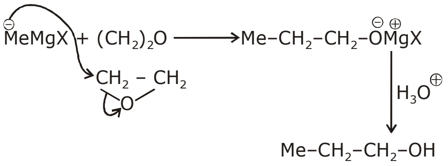


Q.22 **(A,B)**

(A) EtMgX +



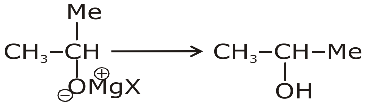
(B)



(C) EtMgX + 1/2 O_2

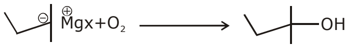
$\longrightarrow Et - \overset{\ominus}{O}\overset{\oplus}{Mg}X \xrightarrow{H^{\oplus}}$ EtOH

(D) MeMgX + CH_3–CHO $\longrightarrow$

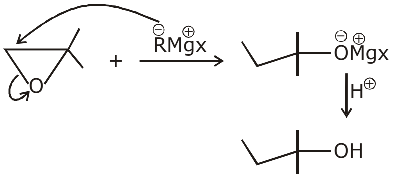


Q.23 **(A,B,CD)**

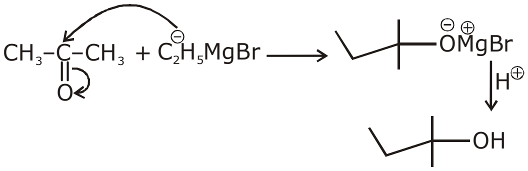
(A)



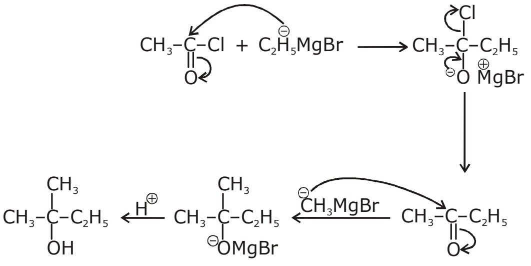
(B)



(C)

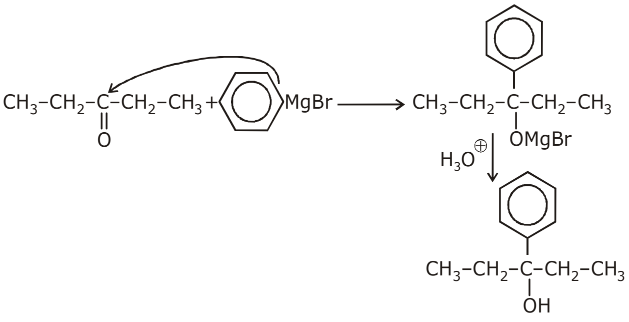


(D)

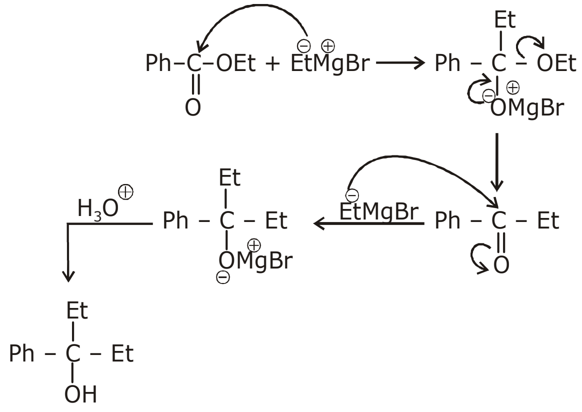


Q.24 **(ABC)**

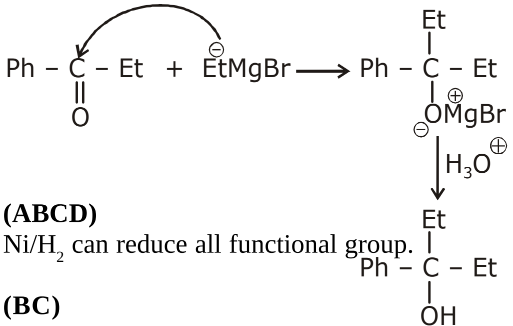
(A



(B)



(C)



Q.25 **(ABCD)**

Ni/H_2 can reduce all functional group.

Q.26 **(BC)**

For partial reduction of alkyne lindlar catalyst and Ni_2B or P-2 catalyst used.

Q.27 **(ABC)**

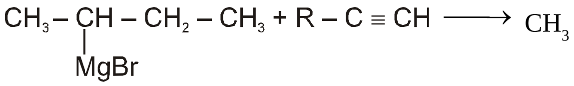
–COCl converts in –CHO by H_2/Pd-$BaSO_4$

Q.28 **(BC)**

$$Ph-C\equiv C-Ph \xrightarrow[(1)]{H_2/Pd/BaSO_4/Quinoline}$$

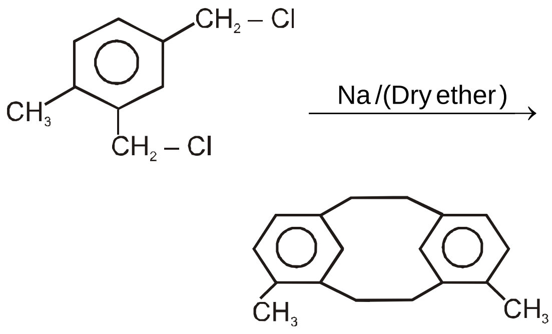
$$\underset{trans}{Ph\text{–}CH\text{=}CH\text{–}Ph} \xrightarrow[(2)]{D_2/Ni} \underset{meso}{Ph\text{–}CHD\text{–}CHD\text{–}Ph}$$

Q.29 **(BD)**



$$CH_3-\underset{\displaystyle MgBr}{\underset{|}{C}}H-CH_2-CH_3+R-C\equiv CH\longrightarrow CH_3-CH_2-CH_2-CH_3+R-C\equiv C-MgBr$$

Q.30 **(AB)**

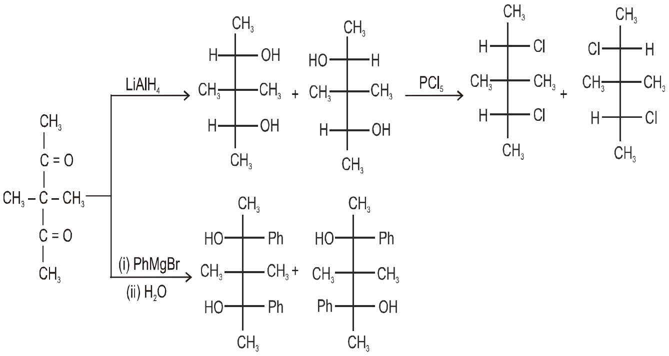


Q.31 (D) (B) and (C) both

Q.32 (D) (A) and (B) both

Q.33 (D) All

(31 to 33)

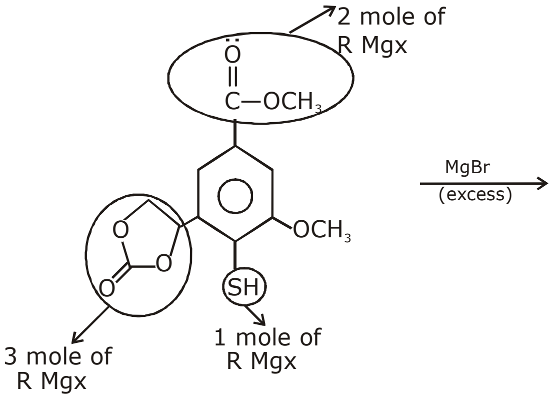


Q.34 **(C)**

Q.35 **(C)**

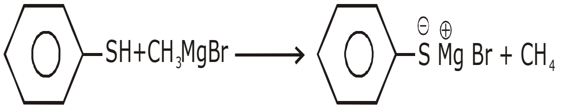
Q.36 **(C)**

34

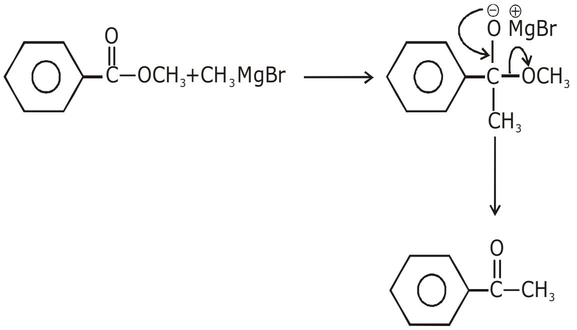


Total No. of R mgx consumed in one mole above comp = 6

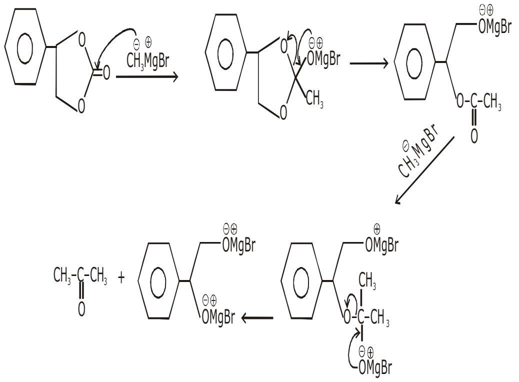
35 (i)



(ii)



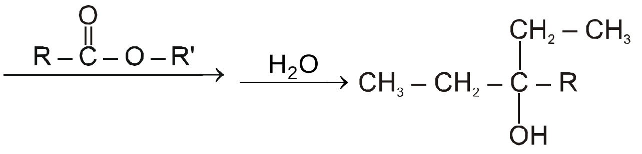
(iii)



36 $\mathrm{Me\,MgBr + PhOH \longrightarrow Me{-}H + Ph\,\overset{\ominus}{O}\,\overset{\oplus}{Mg}Br}$

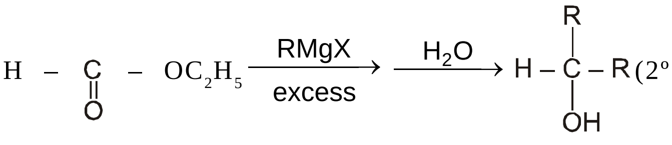
Q.37 (C)

$$CH_3CH_2Cl\xrightarrow[\text{ether}]{\text{Mg}}CH_3CH_2MgCl$$



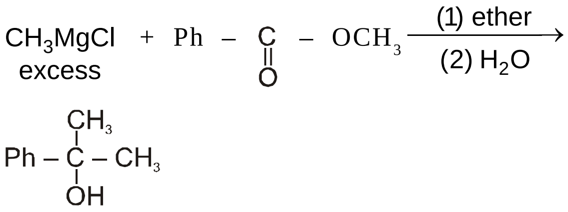
$$R-\overset{\displaystyle O}{\overset{||}{C}}-O-R'\longrightarrow\xrightarrow{H_2O}CH_3-CH_2-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_2-CH_3}{\overset{|}{C}}}}-R$$

Q.38 (A)



$$H-\underset{\displaystyle O}{\underset{||}{C}}-OC_2H_5\xrightarrow[\text{excess}]{RMgX}\xrightarrow{H_2O}H-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle R}{\overset{|}{C}}}}-R\ (2^{o}\ \text{Alcohol})$$

Q.39 (B)



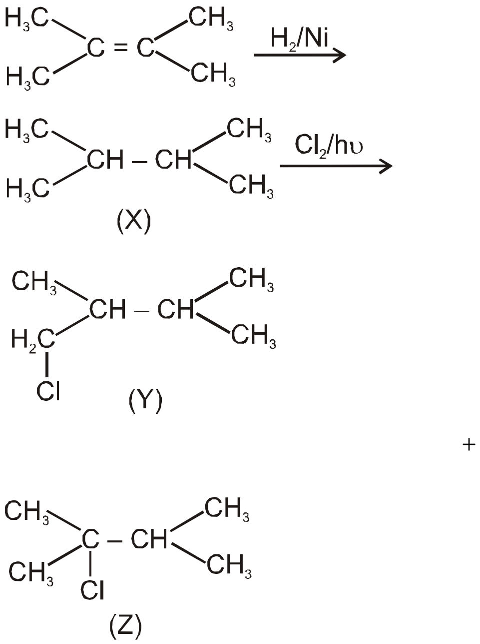
$$\underset{\text{excess}}{CH_3MgCl} + Ph-\underset{\underset{O}{\parallel}}{C}-OCH_3 \xrightarrow[(2)\ H_2O]{(1)\ ether} Ph-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$$

Q.40 (C)

Q.41 (C)

Q.42 (A)

(40 to 42)



Q.43 (B)

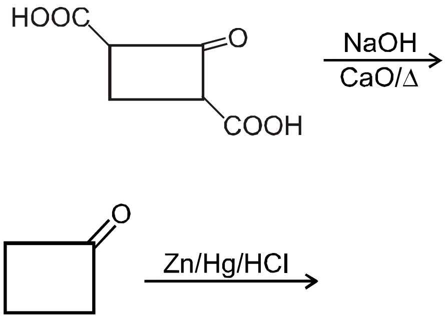
Q.44 (B)

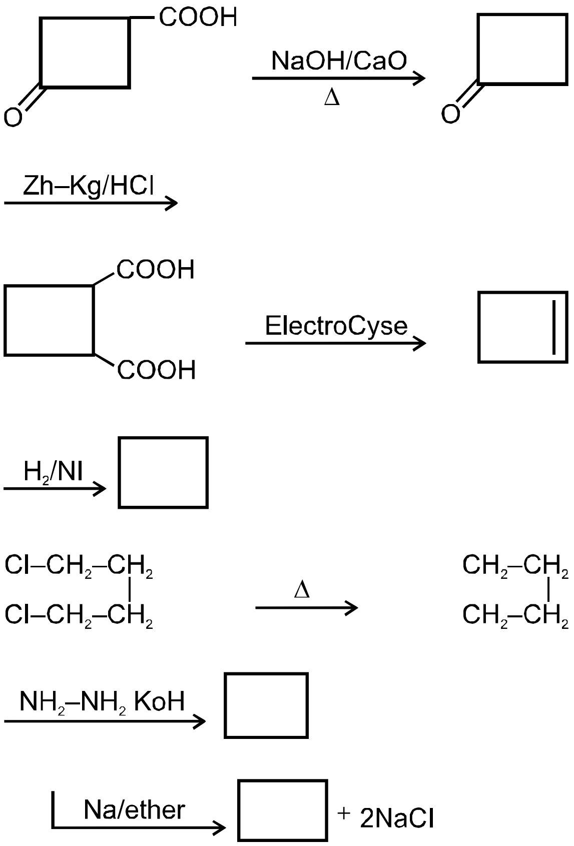
(43 to 44)

$$\text{Heat of hydrogenation} \propto \frac{1}{\text{stability of alkene}}$$

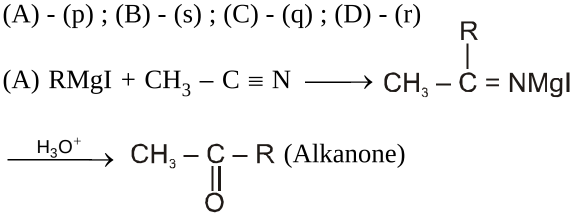
Q.45

(A) - (p, r) ; (B) - (r) ; (C) - (r,s) ; (D) - (q)



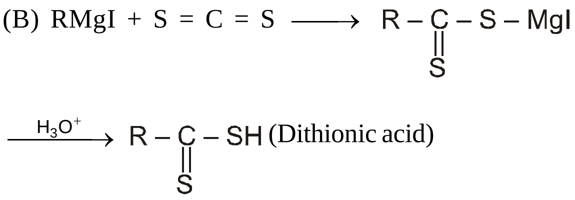


Q.46 (A) - (p) ; (B) - (s) ; (C) - (q) ; (D) - (r)



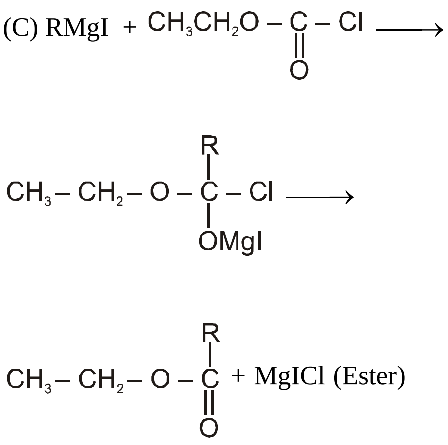
(A) $RMgI + CH_3-C\equiv N \longrightarrow CH_3-\overset{\overset{R}{|}}{C}=NMgI$

$\xrightarrow{H_3O^+} CH_3-\underset{\underset{O}{\parallel}}{C}-R$ (Alkanone)



(B) $RMgI + S=C=S \longrightarrow R-\underset{\underset{S}{\parallel}}{C}-S-MgI$

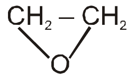
$\xrightarrow{H_3O^+} R-\underset{\underset{S}{\parallel}}{C}-SH$ (Dithionic acid)



(C) RMgI + $CH_3CH_2O-\underset{\underset{O}{\parallel}}{C}-Cl \longrightarrow$

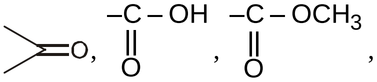
$CH_3-CH_2-O-\overset{\overset{R}{|}}{\underset{\underset{OMgI}{|}}{C}}-Cl \longrightarrow$

$CH_3-CH_2-O-\overset{\overset{R}{|}}{\underset{\underset{O}{\parallel}}{C}}$ + MgICl (Ester)

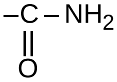
(D) RMgI +  $\longrightarrow$ R – CH_2 – CH_2 –

OMgI $\xrightarrow{H_3O^+}$ R – CH_2 – CH_2 – OH (Alcohol)

Q.47 (A) - (p, q, r, s, t) ; (B) - (p) ; (C) - (p, t) ; (D) - (p)

LiAlH$_4$ can reduce 

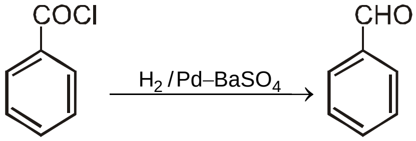
$\rangle C{=}O$, $\underset{\overset{\|}{O}}{-C}-OH$, $\underset{\overset{\|}{O}}{-C}-OCH_3$,

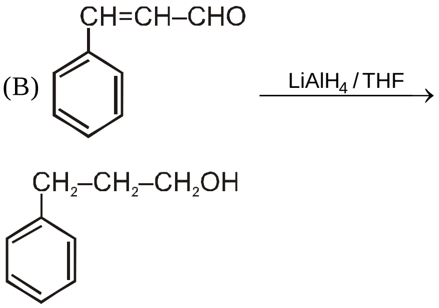


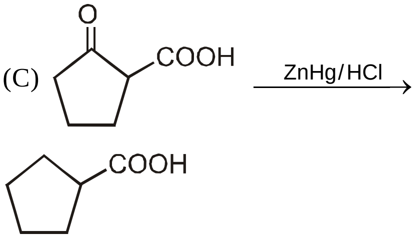
$\underset{\overset{\|}{O}}{-C}-NH_2$ and –NO_2 group.

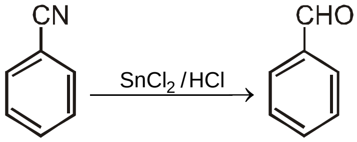
NaBH$_4$ shows selective reduction. If can reduce only keto group of the following function groups.
Na/C_2H_5OH can reduce carbonyl and ester groups.
Keto group can reduced by MPV reduction.

Q.48 (A) - (q) ; (B) - (p) ; (C) - (s) ; (D) - (r)

(A) 

(B) 

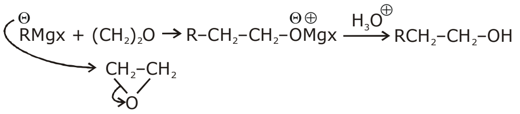
(C) 

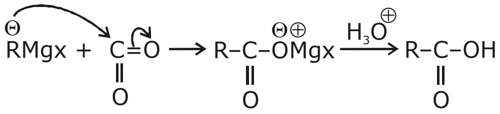
(D) 

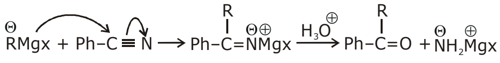
Q.49 **A-q; B-s; C-r; D-p**

(A) RMgx + HCHO $\longrightarrow$ R–CH_2–$\overset{\ominus\ \oplus}{OMgx}$

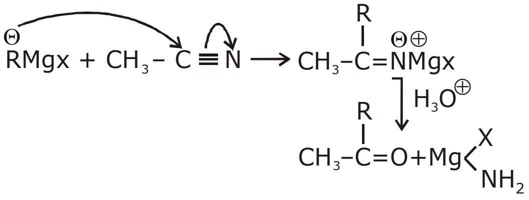
$\xrightarrow{H_3O^{\oplus}}$ R–CH_2–OH

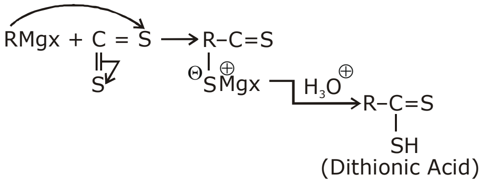
(B) 

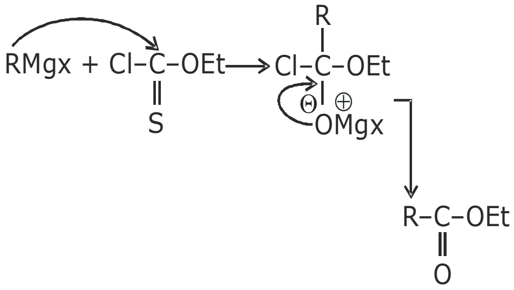
(C) 

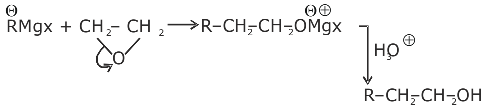
(D) 

Q.50 **A-p; B-s; C-q; D-r**

(A) 

(B) 

(C) 

(D) 

NUMERICAL VALUE BASED

Q.1 [4]

$$\underset{\text{1 mole}}{CH_3MgBr}+\underset{\text{0.25 mole}}{C_2H_5OH}\rightarrow\underset{\text{16 gm}}{CH_4}+C_2H_5OMgBr$$

1 mole of C_2H_5OH will produce 16 gm of CH_4

$\Rightarrow$0.25 mole of C_2H_5OH will produce 4 gm of CH_4

Q.2 [5]

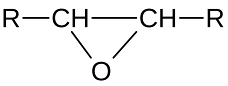
All have acidic hydrogen

Q.3 [3]

Q.4 [3]

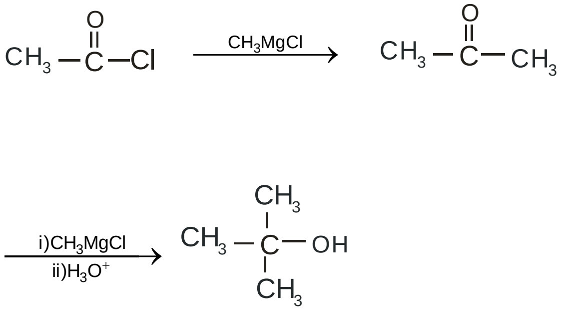
Only except cyclopentane alkane are not hydrogenated

Q.5 [3]

RCOOH gives H^+ where as 

gives alcohol.

Q.6 [2]



$$CH_3-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow{CH_3MgCl} CH_3-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow[ii)H_3O^+]{i)CH_3MgCl} CH_3-\underset{CH_3}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-OH$$

Q.7 [7]

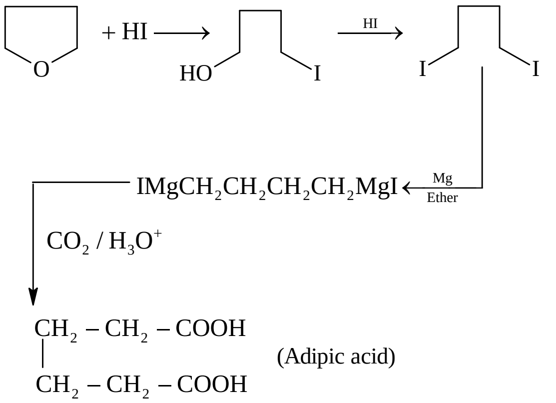
(A) 1 mole each with $-OH$, $-C\equiv CH$ and $-COCH_3$

(B) 2 mole each with COOEt and COCl Total = 7

Q.8 [6]

$R - Mg - X + SiCl_4 \longrightarrow$ Alkyl chloro silane

Q.9 [6]



JEE-MAIN
PREVIOUS YEAR'S

Q.1 (2)

Q.2 (2)

Q.3 (1)

Q.4 (1)

Q.5 **(1)**

Oxidation and Reduction

EXERCISES

JEE-MAIN
OBJECTIVE QUESTIONS

Q.1 (B)

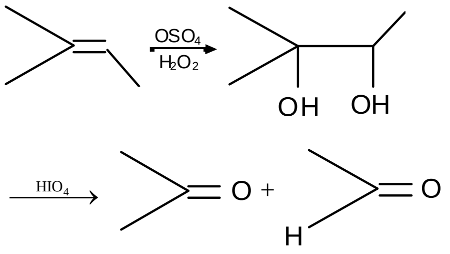
Q.2 (C)

Q.3 (C)

Q.4 (D)

Q.5 (A)

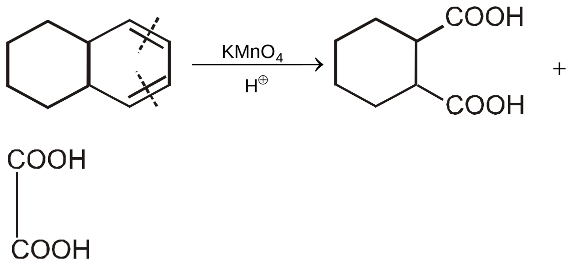
Q.6 (A)



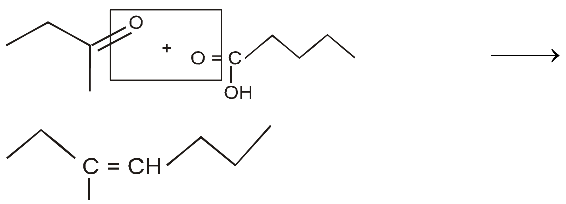
Syn addition

Q.7 (C)
Q.8 (B)

Q.9 (D)



Q.10 (C)
2° alcohol on oxidation with Cu gives ketone.
Q.11 (A)

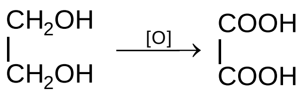


Q.12 (A)

Alkene $\xrightarrow[(2)\,Zn+H_2O]{(1)\,O_3}$ CH_3CHO only

Q.13 (C)
All unsaturated hydrocarbons gives Baeyer's reagent test.

Q.14 (C)

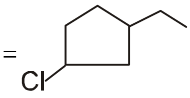
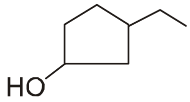


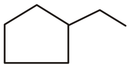
$$\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix} \xrightarrow{[O]} \begin{matrix} COOH \\ | \\ COOH \end{matrix}$$

Q.15 (C)

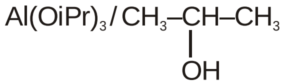
$$CH_3-CH_2-C\equiv CH \xrightarrow{KMnO_4\,/\,H^{\oplus}} CH_3CH_2COOH + CO_2 + H_2O$$

Q.16 (D)

M =  , N =  ,

Y = 

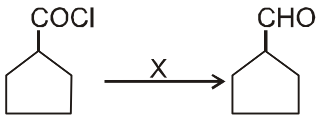
Q.17 (D)
X can be $NaBH_4$/EtOH or $LiAlH_4$/THF or



$$Al(OiPr)_3\,/\,CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$$

Q.18 (B)
$NaBH_4$ can not reduces ester.

Q.19 (A)
Rate of hydrogenation will decreases on increasing steric hinderance at π bond.
Q.20 (A)



X can be

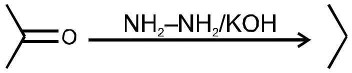
(A) $NaBH_4$/EtOH	(B) $LiAlH_4$/THF
(C) Na/EtOH	(D) H_2/Pd-$BaSO_4$

(D)
–COCl converts in –CHO by H_2/Pd-$BaSO_4$ (Rosenmund reduction)

Q.22 (B)

Q.23 (B)

Wolf-kishwner reduction (NH_2—NH_2/KOH) give alkane after reduction of carbonyl compound.



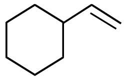
Q.24 (D)

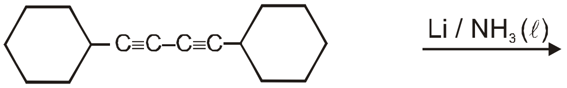
All reagents are used to convert >C = O to >CH_2

Q.25 (C)

Esters are not reduced by $NaBH_4$, >C=O (carbonyl) change to – CH(OH)- by use of $NaBH_4$

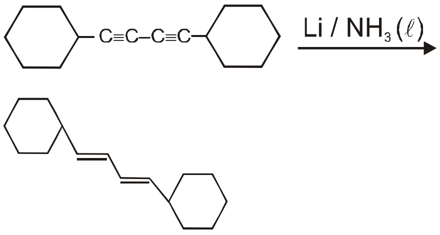
Q.26 (B)

 has maximum heat of hydrogenation and unstabiliity.

Q.27 

product

(B)



Q.28 (D)

It is fact.

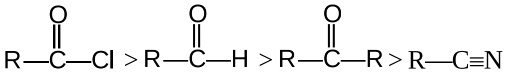
Q.29 (A)

Q.30 (D)

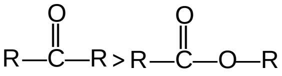
cis-alkene formed by lindlar catalyst and trans - alkene formed by Na/NH_3

Q.31 (D)

Reactivity order for catalytic hydrogenation is

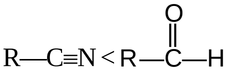


(A) $R-\overset{O}{\overset{\|}{C}}-Cl > R-\overset{O}{\overset{\|}{C}}-H > R-\overset{O}{\overset{\|}{C}}-R > R-C\equiv N$



(B) $R-\overset{O}{\overset{\|}{C}}-R > R-\overset{O}{\overset{\|}{C}}-O-R$

(C) $R-C\equiv CH > R-CH{=}CH_2$



(D) $R-C\equiv N < R-\overset{O}{\overset{\|}{C}}-H$

Q.32 (B)

$Ph-COOH \xrightarrow[\text{Reduction}]{LiAlH_4} Ph-CH_2OH$

Q.33 (A)

Q.34 (B)

Q.35 (A)

Q.36 (C)

Q.37 (B)

Q.38 (B)

Q.39 (C)

$R-NC \xrightarrow{H_2/Pt} R-NH-CH_3$

Q.40 (A)

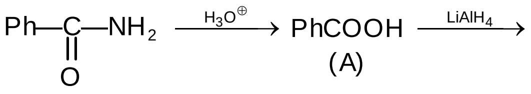
Q.41 (A)

Q.42 (D)

Q.43 (D)

$CH_3-CH_2-C\equiv CH \xrightarrow[NH_4OH]{Cu_2Cl_2} \underset{\text{Blood red Colour}}{CH_3-CH_2-C\equiv \overset{\ominus}{C}\overset{\oplus}{Cu}} + NH_4Cl + H_2O$

Q.44 (B)



$Ph-\underset{\underset{O}{\|}}{C}-NH_2 \xrightarrow{H_3O^{\oplus}} \underset{(A)}{PhCOOH} \xrightarrow{LiAlH_4}$

$\underset{(B)}{Ph-CH_2OH} \xrightarrow{KMnO_4} \underset{(C)}{PhCOOH}$

Q.45 It is fact.

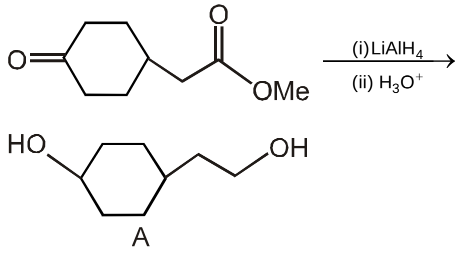
Q.46 (D)

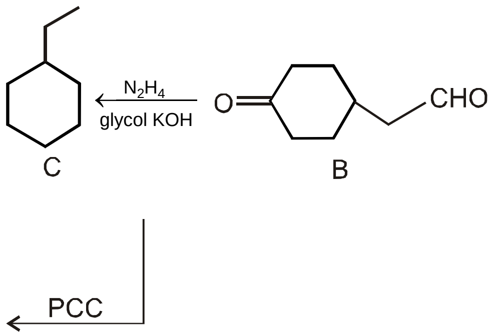
Tollen's reagent is ammonical silvernitrate, which has the species $[Ag(NH_3)_2]^+$.

Q.47 (C)

Fehlings solution is alkaline solution of $CuSO_4$ with rochell salt i.e. sodium potassium tartarate.

Q.48 (D)





Q.49 **(D)**

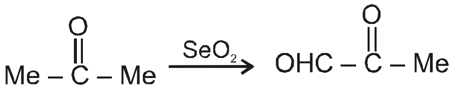
Terminal alkyne gives white ppt with ammonical silver nitrate.

$$CH_3—C\equiv CH + NH_3 + AgNO_3 \rightarrow \underset{\text{white ppt.}}{CH_3—C\equiv C.\,Ag} + NH_4NO_3$$

while propene does not give any reaction with ammonical $AgNO_3$ due to absence of acidic hydrogen.

JEE-ADVANCED
OBJECTIVE QUESTIONS

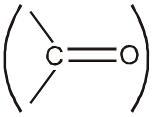
Q.1 (D)

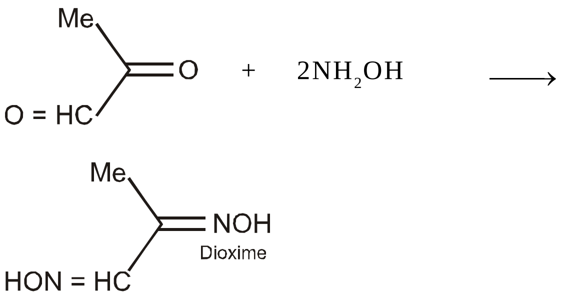


$$Me-\overset{\overset{\displaystyle O}{||}}{C}-Me \xrightarrow{SeO_2} OHC-\overset{\overset{\displaystyle O}{||}}{C}-Me$$

In (a), (P) reduces Tollens reagent, since it contains (–CHO) group.

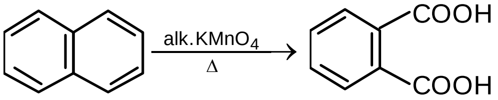
In (b), (P) gives iodoform test, since it contains (MeCO–) group.

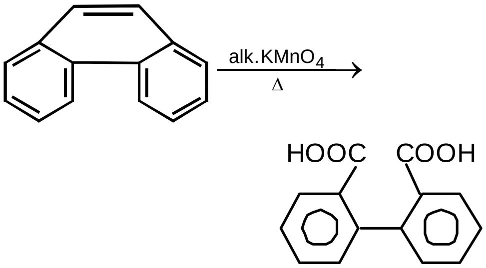
In (c), (P) forms dioxime, since it contains (–CHO) and  groups.

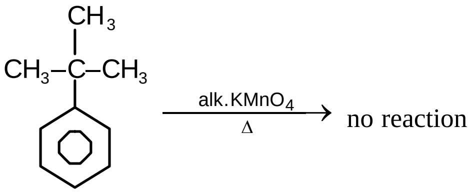


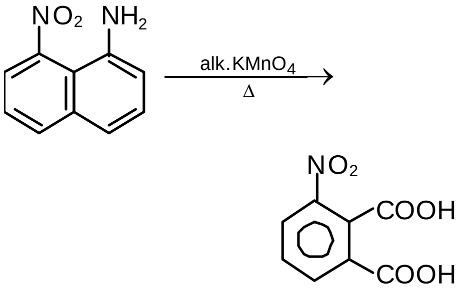
In (d), (P) does not gives cerric ammonium nitrate test, since this test is given by alcohols and (P) does not contain an alcoholic group. So the answer is (D).

Q.2 (C)

(A) 

(B) 

(C) 

(D) 

Q.3 (C)

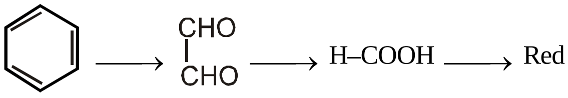
Q.4 (C)

Q.5 (C)

Acetaldehyde reacts with Tollens, Schiff's , and Fehling's solution but acetone does not. But with H_2 / Ni both reacts.

Q.6 (B)

Q.7 (D)



colour

(A) (B) (C)

Q.8 (C)

Acidic $KMnO_4$ breaks the double bond and also oxidises 2° alcohol to ketone, whereas PCC only oxidises 2° alcohol to ketone. So the answer is (C).

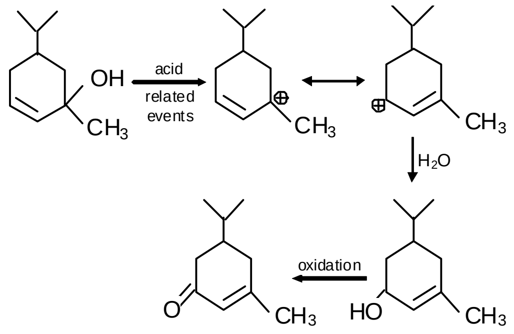
Q.9 (D)

Only primary and secondary alcohols will be able to change the colour as they will be easily oxidised by CrO_3 / aq. H_2SO_4.

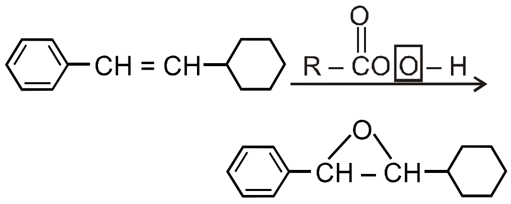
Q.10 (D)

Q.11 (B)

Rearrangement of 3° allylic alcohol.

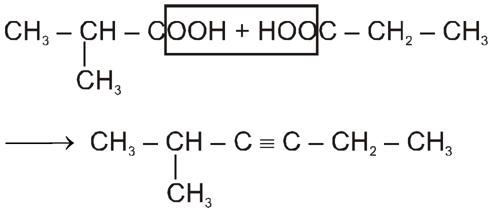


Q.12 (A)



Q.13 (D)

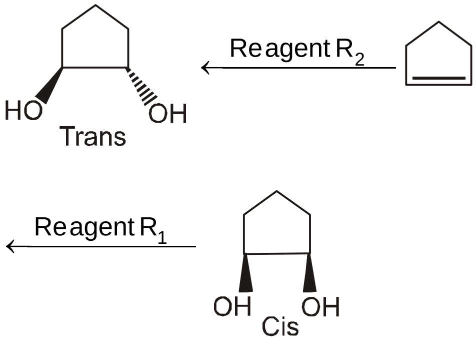
Q.14 (C)



$$\mathrm{CH_3-\underset{CH_3}{\underset{|}{CH}}-C\boxed{OOH + HOO}C-CH_2-CH_3}$$

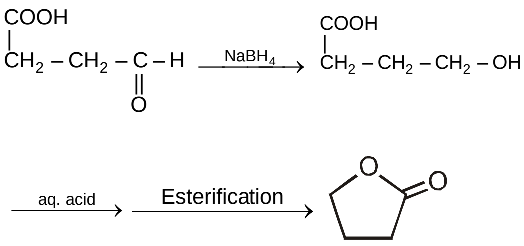
$$\longrightarrow \mathrm{CH_3-\underset{CH_3}{\underset{|}{CH}}-C\equiv C-CH_2-CH_3}$$

Q.15 (B)



Syn addition with Baeyer's Reagent, So cis will form meso compound however peroxy acid in anti addition gives enantiomer.

Q.16 (A)



Q.17 (B)
Oppenauer's oxidation, oxidised secondary alcohol into ketone and there is no effect on double bond.

Q.18 (C)
(P) on hydrolysis gives propanedioic acid and methanol. Propanedioic acid on strong heating gives acetic acid which when reduced with Red P/HI gives ethane.

Q.19 (A)
It is birch reduction

Q.20 (B)

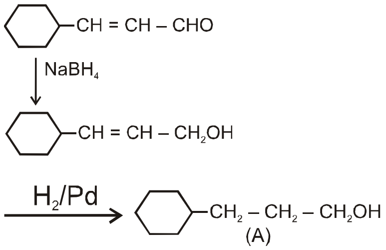
Q.21 (D)
Syn addition of H_2 on double bond and racemic mixture obtained

Q.22 (B)

Q.23 (B)
It is birch reduction.

Q.24 (A)

Q.25 (C)
Q.26 (B)

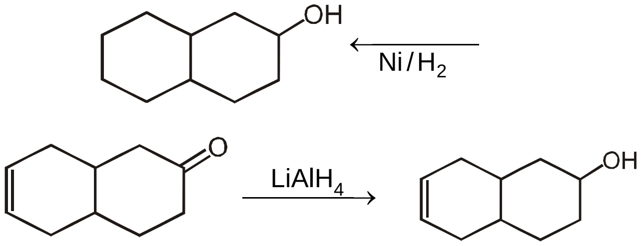


(B)

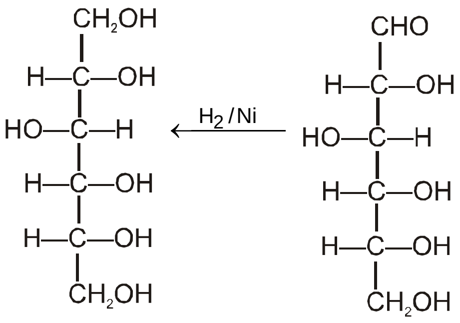
Q.27 (B)
Reduction with Wilkinson's catalyst is homogeneous

Q.28 (A)

Q.29 (D)



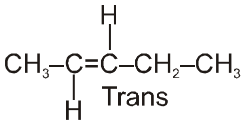
Q.30 (D)



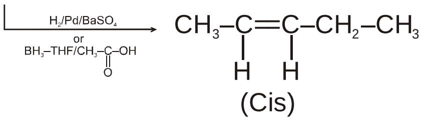
$\xrightarrow{P+HI} C_6H_{14}$(n-Hexane)

Q.31 (D)

$CH_3–C \equiv C–CH_2–CH_3 \xrightarrow{Na/NH_3(\ell)}$

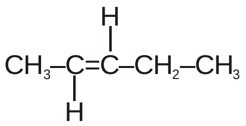


$CH_3–\underset{H}{C}=\overset{H}{C}–CH_2–CH_3$ Trans

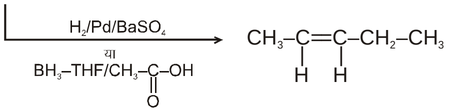


$\xrightarrow[BH_3–THF/CH_3–\underset{O}{\underset{||}{C}}–OH]{H_2/Pd/BaSO_4 \text{ or}} CH_3–\underset{H}{C}=\underset{H}{C}–CH_2–CH_3$ (Cis)

$CH_3–C \equiv C–CH_2–CH_3 \xrightarrow{Na/NH_3(\ell)}$

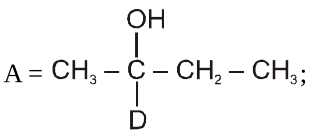


$CH_3–\underset{H}{C}=\overset{H}{C}–CH_2–CH_3$

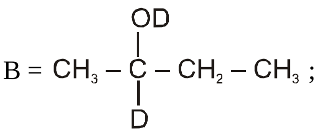


$\xrightarrow[BH_3–THF/CH_3–\underset{O}{\underset{||}{C}}–OH]{H_2/Pd/BaSO_4 \text{ या}} CH_3–\underset{H}{C}=\underset{H}{C}–CH_2–CH_3$

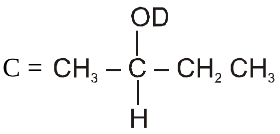
Q.32 (B)



$A = CH_3–\overset{OH}{\underset{D}{C}}–CH_2–CH_3;$

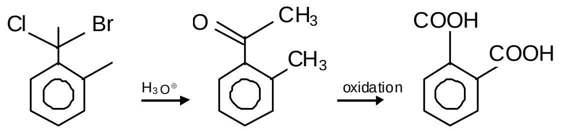


$B = CH_3–\overset{OD}{\underset{D}{C}}–CH_2–CH_3\ ;$

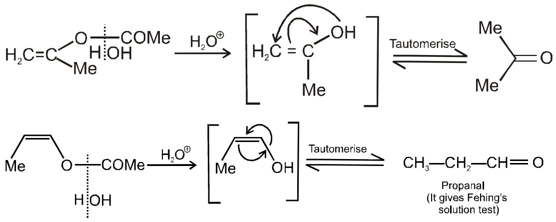


$C = CH_3–\overset{OD}{\underset{H}{C}}–CH_2\,CH_3$

Q.33 (B)

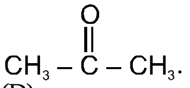


Q.34 (C)



Q.35 (C)

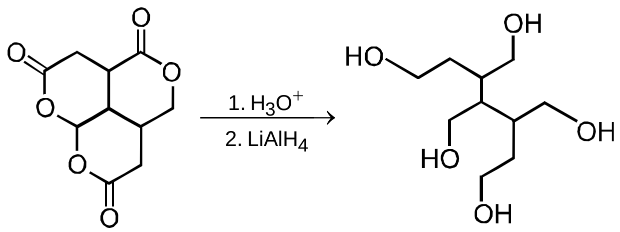
Only C on hydrolysis gives CH_3 – OH and



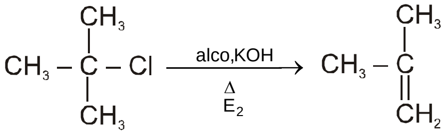
$CH_3–\overset{O}{\overset{||}{C}}–CH_3.$

Q.36 (D)

Q.37 (B)

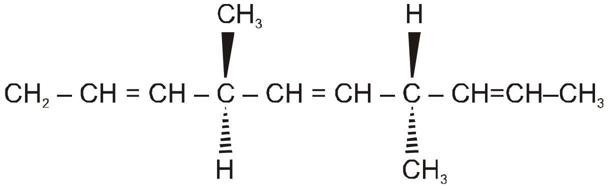


Q.38 (B)

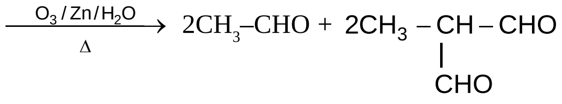


$CH_3–\overset{CH_3}{\underset{CH_3}{C}}–Cl \xrightarrow[\Delta \; E_2]{\text{alco,KOH}} CH_3–\underset{CH_2}{\underset{||}{\overset{CH_3}{C}}}$

Q.39 (C)



$CH_2–CH=CH–\overset{CH_3}{\underset{H}{C}}–CH=CH–\overset{H}{\underset{CH_3}{C}}–CH=CH–CH_3$

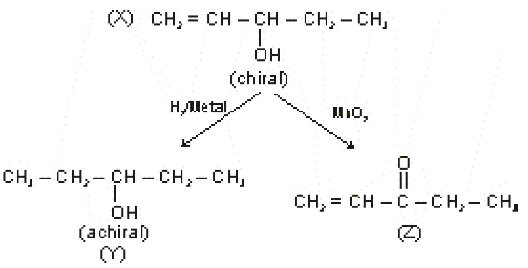


$\xrightarrow[\Delta]{O_3/Zn/H_2O} 2CH_3–CHO + 2CH_3–\underset{CHO}{CH}–CHO$

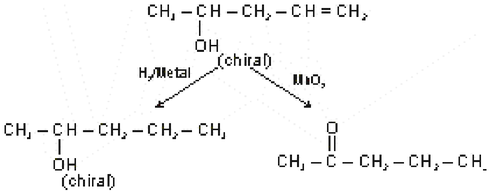
All optically inactive products

Q.40 (A)

(a)



(b)



JEE-ADVANCED

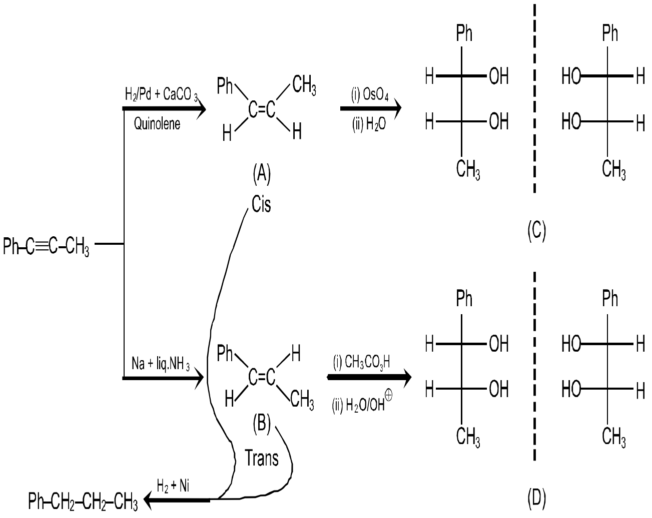
MCQ/COMPREHENSION/COLUMN MATCHING

Q.1 **(A,B,C,D)**

HIO_4 is a mild oxidising agent.

Cyclic intermediate is formed with vicinal diols.

Q.2 **(A,B,C)**



Q.3 **(B,C)**

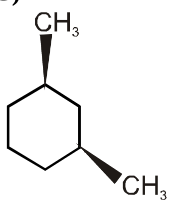
$$Ph-C\equiv C-Ph \xrightarrow[(1)]{H_2/Pd/BaSO_4/Quinoline} Ph-CH=CH-Ph \xrightarrow[(2)]{D_2/Ni} Ph-CHD-CHD-Ph$$

trans

meso

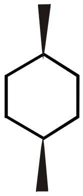
Q.4 **(A,C)**

(A)



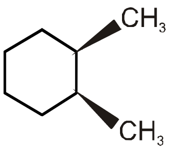
meso

(B)



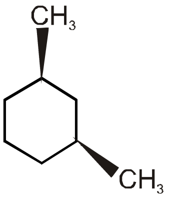
Not meso

(C)

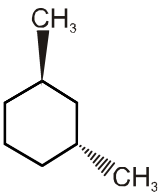


meso

(D)



and



Both

Q.5 **(A,B,C,D)**

For partial reduction of alkyne lindlar catalyst and Ni_2B (P-2 catalyst) are used.

Q.6 **(A,B)**

Q.7 **(C)**

Q.8 **(A,B)**

Q.9 **(B,C)**

When alcohols are passed into Cu tube at 300ºC;
primary alcohol → Aldehyde

Secondary alcohol → Ketone

Tertiary alcohol → Alkene
When alcohols are treated with PCC then ;
primary alcohol → Aldehyde

Secondary alcohol → Ketone

Tertiary alcohol → No reaction

Q.10 **(A, B, C)**

Self explanatory.

Q.11 **(A,B,C,D)**

Q.12 **(D)**

$LiAlH_4$ raduces aldehydes, ketones as well as esters. Pd/H_2 reduces aldehyde & ketone, but ester is practically left behind. Hence (D).

Q.13 **(C)**

$NaBD_4$ can reduce aldehyde and ketone, but not ester. Hence ester remains unchanged.

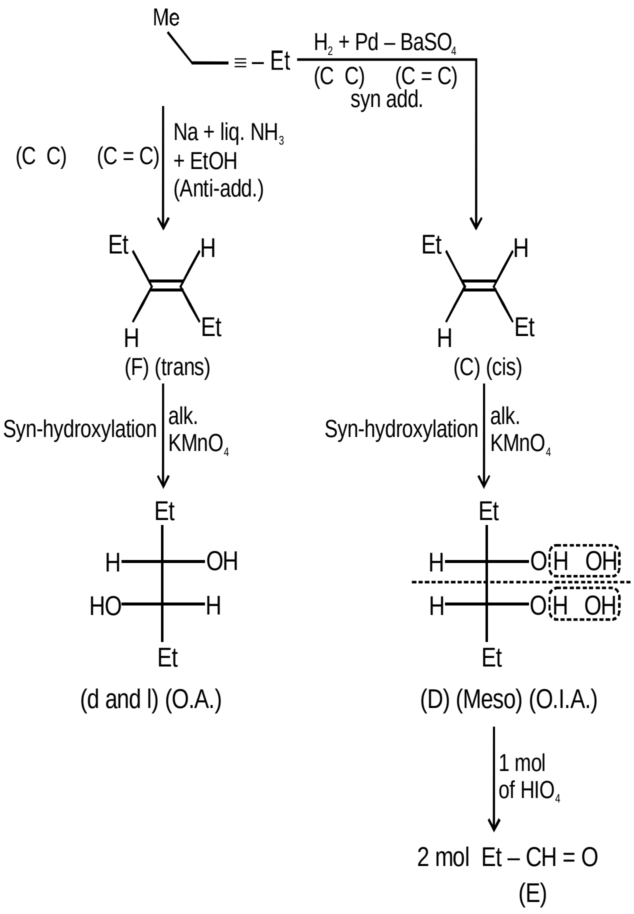
Q.14 **(A)**

Q.15 **(B)**

Q.16 **(A)**

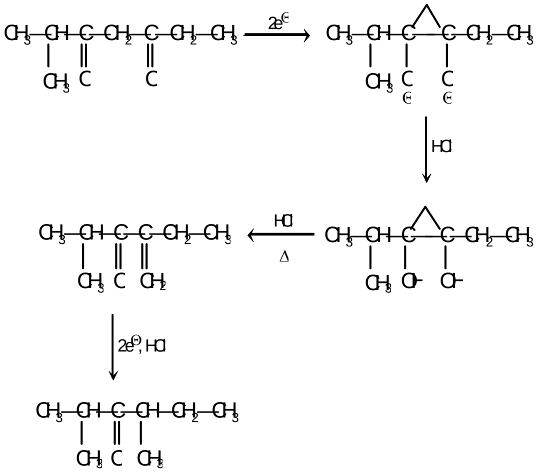
Q.17 **(D)**

Q.18 **(A)**



Q.199 D)

Q.20 **(D)**



Q.21 **(A,D)**

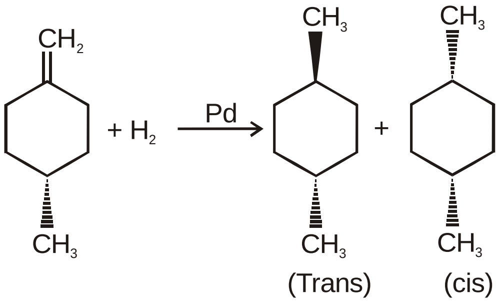
Q.22 (A) – (q) ; (B) – (s) ; (C) – (p, s) ; (D) – (q, s)

Q.23 (A) – (p) ; (B) – (q) ; (C) – (t) ; (D) – (s).

Q.24 A → s; B → r; C → p; D → q

NUMERICAL VALUE BASED

Q.1 [2]



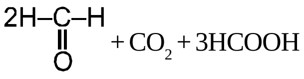
Q.2 [3] (i, ii, iv)

Correct reaction are (i), (ii), (iv)

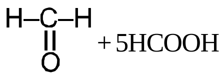
(iii) Benzylic hydrogen is absent

(v) Racemic mixture is formed

Q.3 [3]

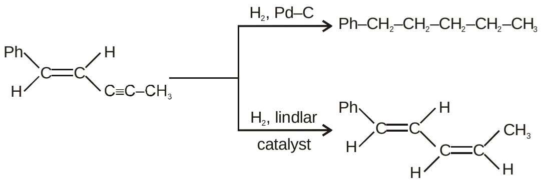
(i) 

$2H\text{–}\underset{\|\atop O}{C}\text{–}H + CO_2 + 3HCOOH$

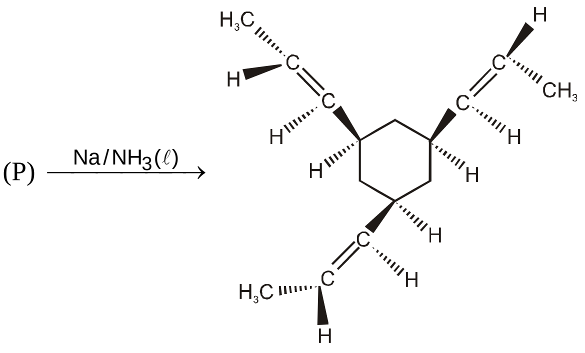
(ii) 

$H\text{–}\underset{\|\atop O}{C}\text{–}H + 5HCOOH$

Q.4 [4]



Q.5 [5]



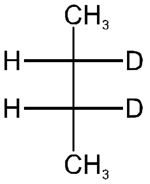
D.u. = X = 4 ; Y = 1

Q.6 [4]
All four reactions gives $CH_3 - CHO$ as major product.

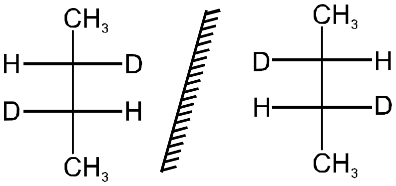
Q.7 [4]
All four reactions gives $CH_3 - CHO$ as major product.

Q.8 [3]
x = 1 (meso)
y = 2 (racemic mixture)

x is

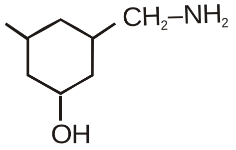


y is

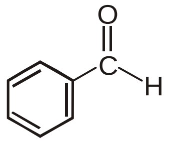


Q.9 [3]

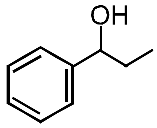
(a)



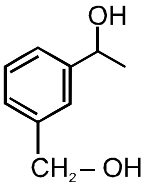
(b)



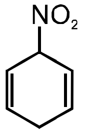
(c)



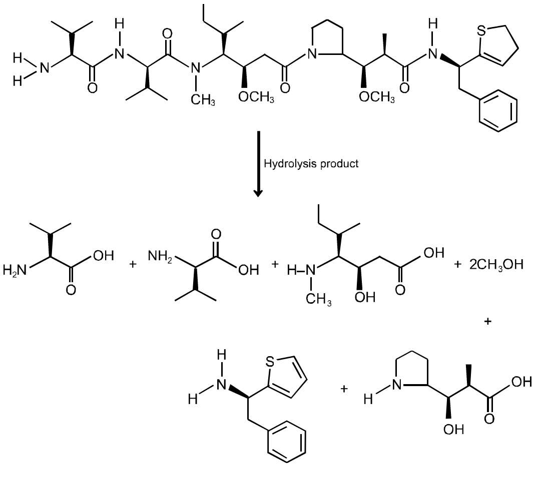
(d)



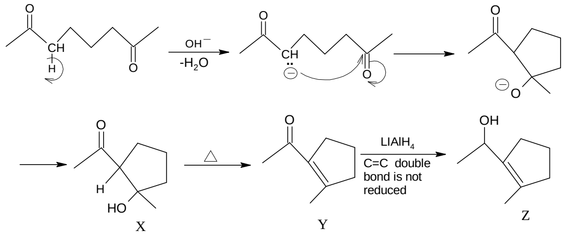
(e)



Q.10 [6]



Q.11 [1]



Q.12 [4]

Carbonyl compound as well as acid and acid derivatives are reduced by $LiAlH_4$.

Q.13 [3]

Q.14 [4]

Q.15 [2]

Q.16 [4]

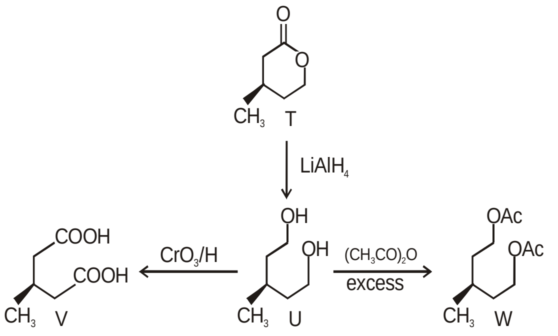
$$\text{Fructose} \xrightarrow{HIO_4} 2HCHO + 4HCOOH$$

JEE-MAINS PREVIOUS YEAR'S

Q.1 (4)
Q.2 (3)
Q.3 (3)

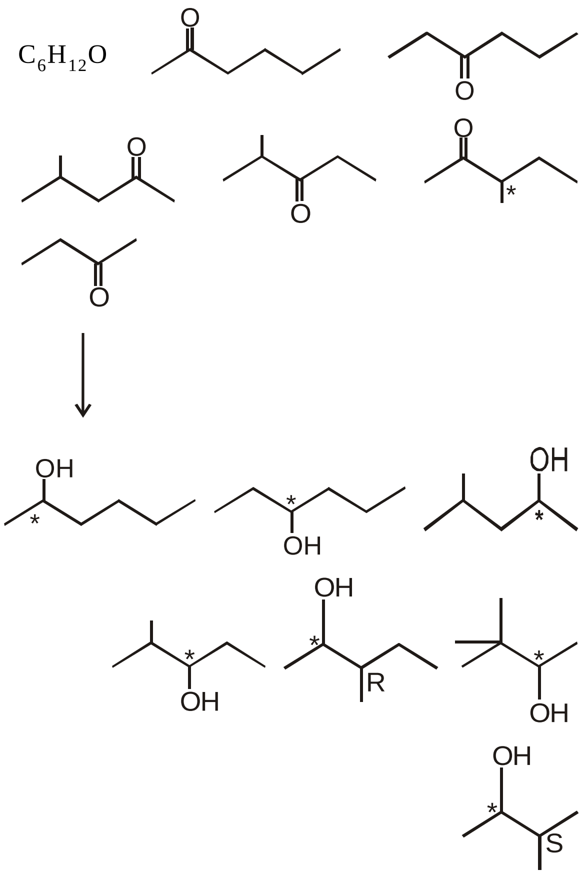
JEE-ADVANCED PREVIOUS YEAR'S

Q.1 (A) (C) (D)



Q.2 [5]
$C_nH_{2n}O, M_W = 12n + 2n + 16 = 100$
$\therefore 14n = 84 \qquad \therefore n = 6$
Six such ketones exist :

$C_6H_{12}O$



(+) & (–) (+) & (–) (+) & (–)

(+) & (–) diastere.

(+) & (–) diaste.

Thus, 5 such ketones give a racemic mixture.

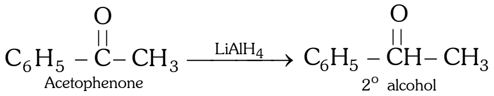
Alcohols and Ethers

EXERCISES

ELEMENTARY

Q.1 (3)

Q.2 (2)



$$C_6H_5-\overset{\overset{O}{||}}{C}-CH_3 \xrightarrow{LiAlH_4} C_6H_5-\overset{\overset{O}{||}}{CH}-CH_3$$

Acetophenone; 2° alcohol

Q.3 (4)

Q.4 **(4)**

As the surface area and molecular weight increases solubility decreases. So t-butyl alcohol has least surface area hence its solubility is highest.

Q.5 (1)

Due to H-bonding glycerol boiling point is more than propanol.

Q.6 (3)

$$CH_3-CH_2-OH \xrightarrow[170^{o}\,C]{Conc.\ H_2SO_4} CH_2=CH_2+H_2O$$

Q.7 (1)

Q.8 (4) H_2SO_4, Al_2O_3 and H_3PO_4 all can act as dehydrating agent.

Q.9 **(3)**

Primary alcohol produces turbidity with lucas reagent most slowly i.e. Isobutyl alcohol.

Q.10 (2)

Alcohol and Acid react with sodium
Alcohol react with sodium to give H_2 gas
Acid react with sodium to give carbonic acid
Ether donot react with sodium

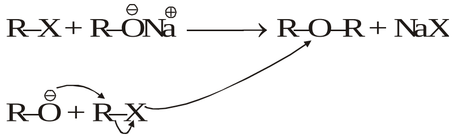
Q.11 (2)
Q.12 **(1)**
Q.13 (2)

$$CH_3CH_2-OH+HO-CH_2-CH_3 \xrightarrow[140^{o}C]{Conc.\ H_2SO_4}$$

$$\underset{\text{Diethyl ether}}{CH_3CH_2-O-CH_2-CH_3}+H_2O$$

Q.14 **(2)**

Q.15 **(3)**

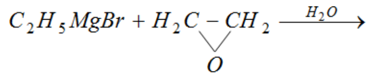


$$R-X+R-\overset{\ominus}{O}\overset{\oplus}{Na} \longrightarrow R-O-R+NaX$$

$$R-\overset{\ominus}{O}+R-X$$

It is an example of Biomolecular neucliophilic substitution reaction. i.e. SN^2.

Q.16 (2)



$$C_2H_5MgBr+H_2C-CH_2 \xrightarrow{H_2O}$$

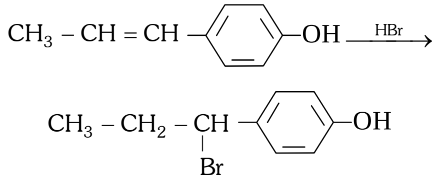
$$\underset{\substack{(A)\\ \text{n-butyl alcohol}}}{C_2H_5CH_2CH_2OH}+MgBr(OH)$$

Q.17 **(1,4)**

Q.18 (2)

$$R-O-R+HX \longrightarrow RX+R-OH \xrightarrow{HX} R-X+H_2O$$

Q.19 (2)



JEE-MAIN
OBJECTIVE QUESTIONS

Q.1 (4)

Due to less-effective hydrogen bonding solubility of $Ph-CH_2-CH_2-CH_2-OH$ becomes minimum.

Q.2 (4)

$$\text{Acidic nature} \propto \frac{1}{\text{pka}-\text{value}}$$

Acidity of $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2OH$ is minimum due to +I -effect isopropyl group.

Q.3 (2)

ue to effective hydrogen bonding boiling point of unbranched alcohol is more than branched chain alcohol.

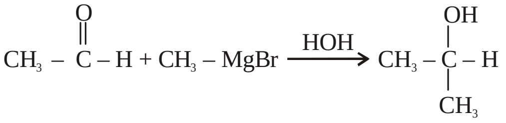
Q.4 (1)
Q.5 (4)

$$\mathrm{CH_3-NH_2 \xrightarrow[\substack{O\text{–}4^\circ C\\ -H_2O}]{HNO_2+HCl} \{CH_3-\overset{\oplus}{N}\equiv N\}\overset{\ominus}{Cl} \longrightarrow \overset{\oplus}{CH_3} \xrightarrow{HOH} CH_3-OH}$$

$$\mathrm{\overset{\oplus}{CH_3} + CH_3-OH \xrightarrow{-H^{\oplus}} CH_3-O-CH_3}\quad \text{(B)}$$

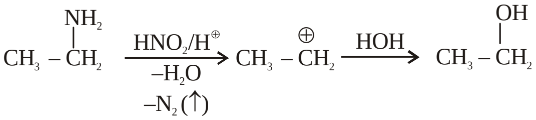
$$\mathrm{\overset{\oplus}{CH_3} + HNO_2 \xrightarrow{-H^{\oplus}} CH_3-ONO}\quad \text{(C)}$$

Q.6 (2)



$$\mathrm{CH_3-\overset{\overset{O}{\|}}{C}-H + CH_3-MgBr \xrightarrow{HOH} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-H}$$

Q.7 (2)

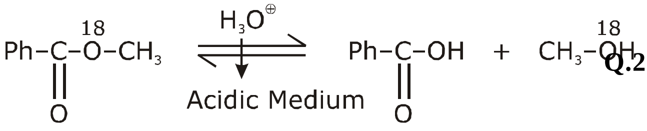


$$\mathrm{CH_3-\overset{\overset{NH_2}{|}}{CH_2} \xrightarrow[\substack{-H_2O\\ -N_2(\uparrow)}]{HNO_2/H^{\oplus}} CH_3-\overset{\oplus}{CH_2} \xrightarrow{HOH} CH_3-\overset{\overset{OH}{|}}{CH_2}}$$

Q.8 (1)
Melting point & boiling point of branched chain alcohols are less than unbranched chain alcohol.

Q.9 (4)
`Due to polar $\mathrm{-\overset{\delta-}{O}-\overset{\delta+}{H}}$ bond

Q.10 **(2)**



$$\mathrm{Ph-\underset{\underset{O}{\|}}{C}-\overset{18}{O}-CH_3 \underset{\text{Acidic Medium}}{\overset{H_3O^{\oplus}}{\rightleftharpoons}} Ph-\underset{\underset{O}{\|}}{C}-OH + CH_3-\overset{18}{O}H}$$

Q.11 (1)
Compound which can form hydrogen bond with water are soluble and lower alcohols forming effective hydrogen bond with H_2O. So soluble in H_2O.

Q.12 (2)
Due to presence of lone pair electron on O-atom

Q.13 (2)
Ethers do not form hydrogen bond.

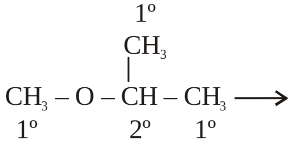
Q.14 (2)

Q.15 (3)

$$\mathrm{R-Br + \overset{\oplus}{Na}\overset{\ominus}{O}R^1 \longrightarrow \underset{\text{Unsymmetrical ether}}{R-O-R^1} + NaBr}$$

Q.16 **(2)**

Q.17 (3)



$$\mathrm{\underset{1^\circ}{CH_3}-O-\underset{2^\circ}{\overset{\overset{\overset{1^\circ}{CH_3}}{|}}{CH}}-\underset{1^\circ}{CH_3}} \longrightarrow$$

It have three 1°, and one – 2° carbon

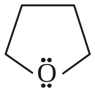
Q.18 B

$$\underbrace{\underset{\text{Diethylther}}{\mathrm{CH_3-CH_2-O-CH_2-CH_3}}\ \&\ \underset{\text{Methylpropylether}}{\mathrm{CH_3-O-CH_2-CH_2-CH_3}}}_{\text{Metamers}}$$

(because alkyl group attached with'O' in both ether are different)

Q.19 **(4)**
Due to electron releasing nature of ethyl group.

Q.20 (4)



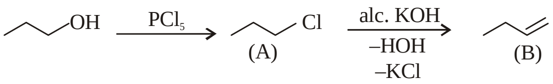
Tetrahydrofuran
(A cyclic ether of 5 member)

Q.21 (3)
Reaction of R–X with KCN does not produce ether.

Q.22 (3)

$$\mathrm{CH_3-CH_2-OH \xrightarrow[\text{Excess amount}]{H_2SO_4/\Delta} CH_3-CH_2-O-CH_2-CH_3}$$

Q.23 B

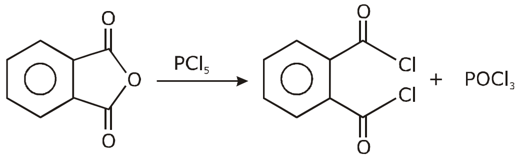


Q.24 (3)

$$\mathrm{R-\ddot{\underset{\cdot\cdot}{O}}-R \xrightarrow{H-I} R-I + HO-R}$$

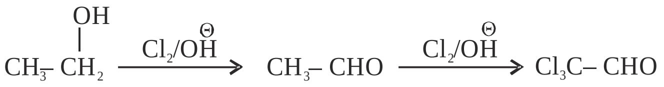
Q.25 **(4)**

Q.26 **(2)**



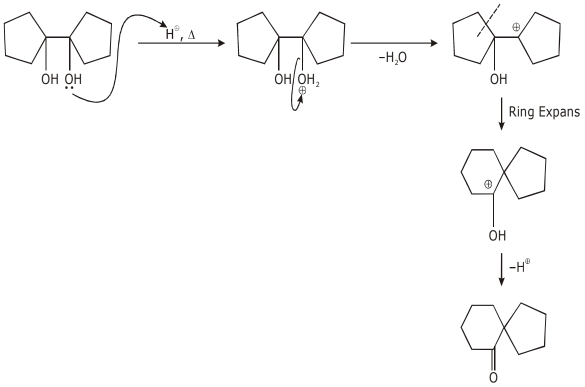
Q.27 B
Decomposition of ether by HI or HBr is called Ziesel's method.

Q.28 (3)



$$\mathrm{CH_3-\overset{\overset{OH}{|}}{CH_2} \xrightarrow{Cl_2/\overset{\ominus}{O}H} CH_3-CHO \xrightarrow{Cl_2/\overset{\ominus}{O}H} Cl_3C-CHO}$$

Q.29 (3)



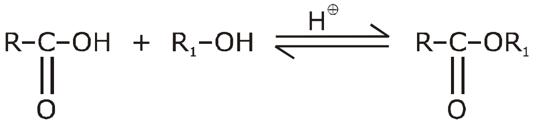
Q.30 (2)

$$\underset{\substack{\text{Sodium ethoxide}\\ \text{(As-Nucleophile)}}}{CH_3 - CH_2 - Br + NaOC_2H_5} \longrightarrow \underset{\text{Diethylether}}{C_2H_5{-}O{-}C_2H_5}$$

Q.31 (4)

Reactivity order of alcohol with Lucas reagent
3º > 2º > 1º alcohol.

Q.32 **(4)**

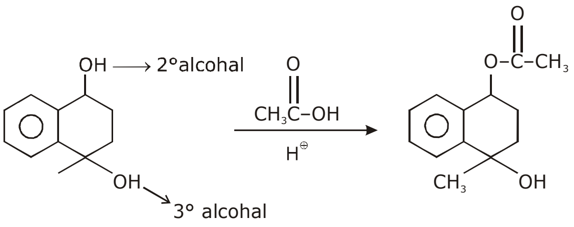


$$R-\underset{\underset{O}{\|}}{C}-OH + R_1-OH \overset{H^{\oplus}}{\rightleftharpoons} R-\underset{\underset{O}{\|}}{C}-OR_1$$

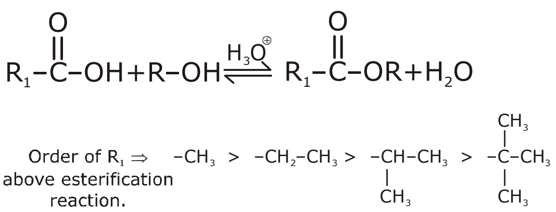
Order of alcohal towards esterification

CH_3–OH > 1°alcohal > 2°alcohal > 3°alchoal.

Q.33 **(2)**



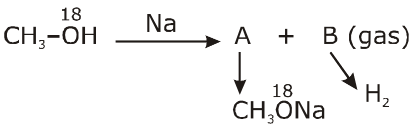
Q.34 **(1)**

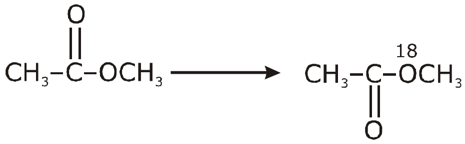


$$R_1-\overset{\overset{O}{\|}}{C}-OH + R-OH \overset{H_3O^{\oplus}}{\rightleftharpoons} R_1-\overset{\overset{O}{\|}}{C}-OR + H_2O$$

Order of R_1 ⇒ above esterification reaction. $-CH_3 > -CH_2-CH_3 > -\underset{\underset{CH_3}{|}}{CH}-CH_3 > -\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$

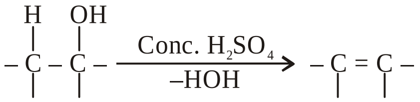
Q.35 **(2)**





$$CH_3-\overset{\overset{O}{\|}}{C}-OCH_3 \longrightarrow CH_3-\underset{\underset{O}{\|}}{C}-\overset{18}{O}CH_3$$

Q.36 (4)



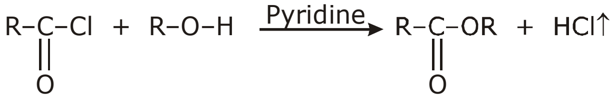
$$-\overset{\overset{H}{|}}{\underset{|}{C}}-\overset{\overset{OH}{|}}{\underset{|}{C}}- \xrightarrow[-HOH]{\text{Conc. } H_2SO_4} -\underset{|}{C}=\underset{|}{C}-$$

This reaction involve breaking of ‘C–O’ bond not ‘O–H’ bond.

Q.37 (1)

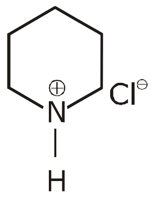
Reactivity order of alcohols with HCl + $ZnCl_2$ (Lucas Reagent) is 3º > 2º > 1º, because stability of carbocation of alcohol is 3º > 2º > 1º.

Q.38 **(3)**

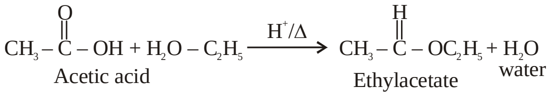


$$R-\underset{\underset{O}{\|}}{C}-Cl + R-O-H \xrightarrow{\text{Pyridine}} R-\underset{\underset{O}{\|}}{C}-OR + HCl\uparrow$$

HCl is formed in above reaction and react with pyridine and gives



Q.39 (2)



$$\underset{\text{Acetic acid}}{CH_3-\overset{\overset{O}{\|}}{C}-OH} + H_2O-C_2H_5 \xrightarrow{H^+/\Delta} \underset{\text{Ethylacetate}}{CH_3-\overset{\overset{H}{\|}}{C}-OC_2H_5} + \underset{\text{water}}{H_2O}$$

Q.40 (2)

$3CH_3 - OH + PCl_3 \rightarrow 3CH_3 - Cl + H_3PO_3$

Methylchloride

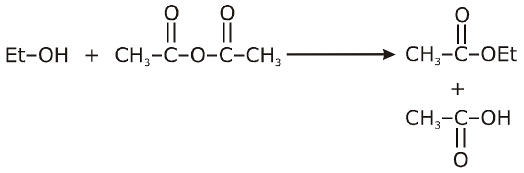
Q.41 (1)

PCl_3, PCl_5, $SOCl_2$, HCl can replace –OH group but not Cl_2.

Q.42 (4)

$R - O - H + Na \longrightarrow R-\overset{\ominus\,\oplus}{ONa} + 1/2\ H_2(\uparrow)$

Q.43 **(3)**

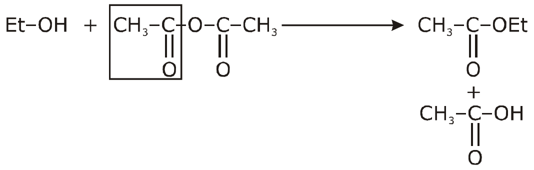


$$\text{Et–OH} + CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3 \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-OEt + CH_3-\underset{O}{\underset{\|}{C}}-OH$$

in above reaction molecular weight of alcohal increase by $C_2H_2O = 42$.

Q.44 2)
SO_2Cl_2 cannot replace –OH group.

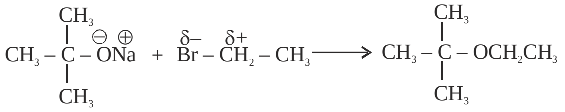
Q.45 **(2)**



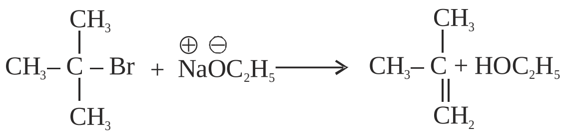
$$\text{Et–OH} + \boxed{CH_3-\underset{O}{\underset{\|}{C}}}-O-\underset{O}{\underset{\|}{C}}-CH_3 \longrightarrow CH_3-\underset{O}{\underset{\|}{C}}-OEt + CH_3-\underset{O}{\underset{\|}{C}}-OH$$

This is acetylation reaction.

Q.46 (1)
(Williumson's synthesis)



$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-\overset{\ominus\ \oplus}{ONa} + \overset{\delta-}{Br}-\overset{\delta+}{CH_2}-CH_3 \longrightarrow CH_3-\overset{CH_3}{\underset{CH_3}{C}}-OCH_2CH_3$$



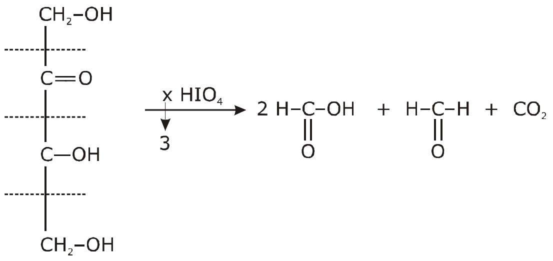
$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Br + \overset{\oplus\ \ominus}{NaOC_2H_5} \longrightarrow CH_3-\overset{CH_3}{\underset{CH_2}{\underset{\|}{C}}} + HOC_2H_5$$

3° – alkyl halide

Q.47 (4)

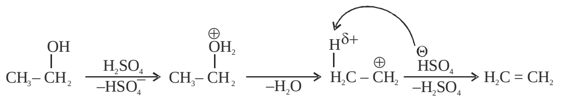
Dilute acidic $KMnO_4$

Q.48 **A**



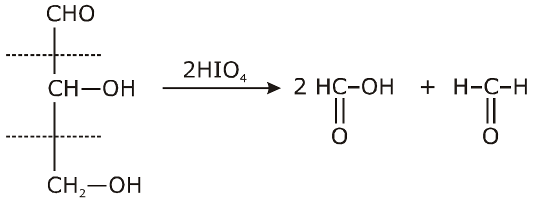
$$\begin{matrix}CH_2-OH\\ C=O\\ C-OH\\ CH_2-OH\end{matrix} \xrightarrow[\ 3\ ]{x\ HIO_4} 2\ H-\underset{O}{\underset{\|}{C}}-OH + H-\underset{O}{\underset{\|}{C}}-H + CO_2$$

Q.49 (3)



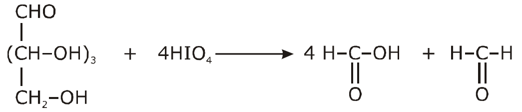
$$CH_3-\overset{OH}{CH_2} \xrightarrow[-HSO_4^-]{H_2SO_4} CH_3-\overset{\oplus}{\overset{OH_2}{CH_2}} \xrightarrow{-H_2O} \overset{H^{\delta+}}{H_2C}-\overset{\oplus}{CH_2} \xrightarrow[-H_2SO_4]{\overset{\ominus}{HSO_4}} H_2C=CH_2$$

Q.50 **(2)**



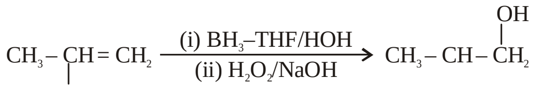
$$\begin{matrix}CHO\\ CH-OH\\ CH_2-OH\end{matrix} \xrightarrow{2HIO_4} 2\ H\underset{O}{\underset{\|}{C}}-OH + H-\underset{O}{\underset{\|}{C}}-H$$

Q.51 **(1)**



$$\begin{matrix}CHO\\ (CH-OH)_3\\ CH_2-OH\end{matrix} + 4HIO_4 \longrightarrow 4\ H-\underset{O}{\underset{\|}{C}}-OH + H-\underset{O}{\underset{\|}{C}}-H$$

Q.52 (1)

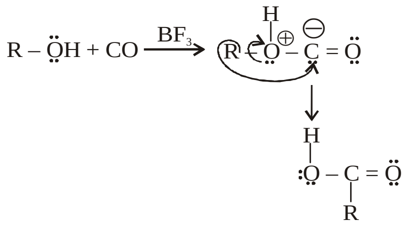


$$CH_3-\underset{CH_3}{CH}=CH_2 \xrightarrow[\text{(ii) } H_2O_2/NaOH]{\text{(i) } BH_3\text{–THF/HOH}} CH_3-CH-\overset{OH}{CH_2}$$

1° –Alcohol

This is a method of addition of HOH molecule by Anti–Markovnikov's Rule.

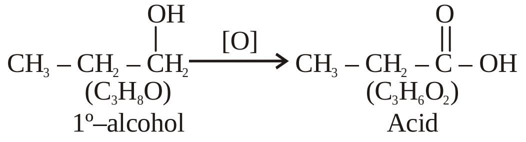
Q.53 (2)



$$R-\ddot{O}H + CO \xrightarrow{BF_3} R-\overset{H}{\overset{\oplus}{O}}-\overset{\ominus}{C}=\ddot{O} \longrightarrow :\overset{H}{O}-\underset{R}{C}=\ddot{O}$$

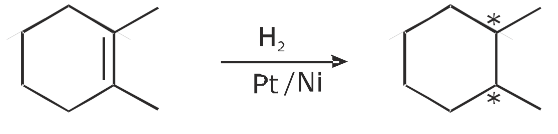
– R = – CH_3
Compound = Acetic acid

Q.54 (3)
Q.55 (1)



$$\underset{\substack{(C_3H_8O)\\ 1^\circ\text{–alcohol}}}{CH_3-CH_2-\overset{OH}{CH_2}} \xrightarrow{[O]} \underset{\substack{(C_3H_6O_2)\\ \text{Acid}}}{CH_3-CH_2-\overset{O}{\overset{\|}{C}}-OH}$$

Q.56 (1)
Q.57 **(3)**

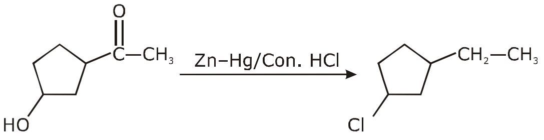


Meso compound

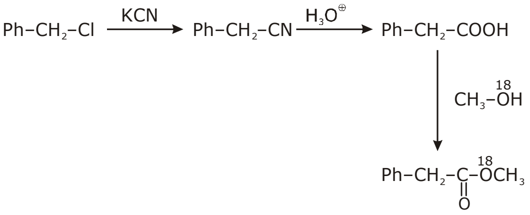
Q.58 (3)

$$CH_3-\overset{\overset{O}{\parallel}}{C}-OH \xrightarrow{LiAlH_4} CH_3-\overset{\overset{OH}{|}}{CH_2}$$

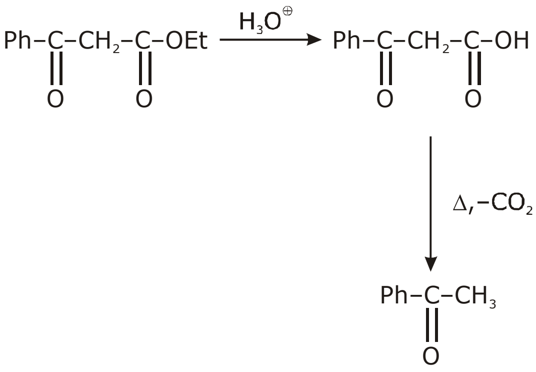
Q.59 **(2)**



Q.60 **(3)**



Q.61 **(2)**

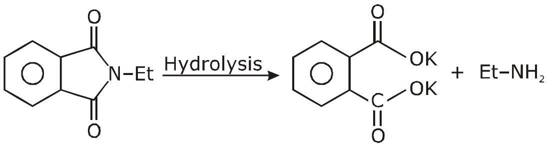


Q.62 **(4)**

Q.63 **(4)**
NaBH$_4$ are weak reducing agent so only acid chloride are reduced in alcohal.

Q.64 **(4)**
CH≡CH, $CH_2=CH_2$, Et–OH are not react with NaOH.

Q.65 **(2)**

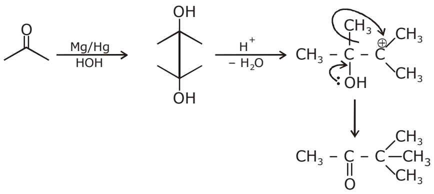


Q.66 (1)

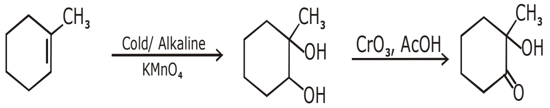
$$\underset{\text{Alcohol}}{R-O-H} + \underset{\text{Alcohol}}{H-O-R} \xrightarrow[-HOH]{H^+/\Delta} \underset{\substack{\text{Anhydride of alcohol}\\ \text{(Ether)}}}{R-O-R}$$

JEE-ADVANCED OBJECTIVE QUESTIONS

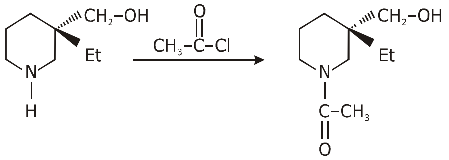
Q.1 **B**



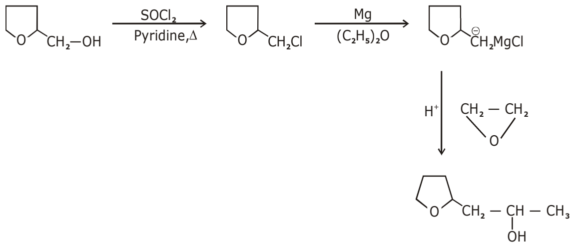
Q.2 **A**



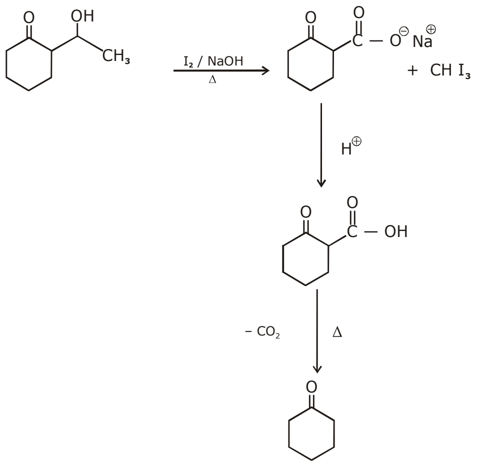
Q.3 **B**



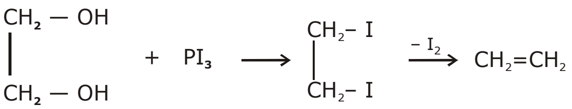
Q.4 **A**



Q.5 **A**

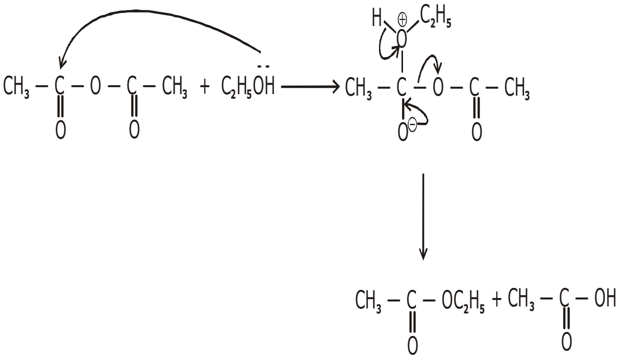


Q.6 **A**

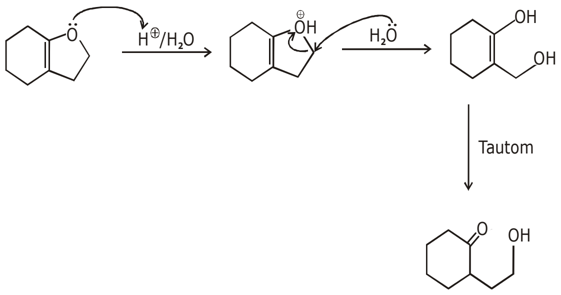


PI_3 reduces glycol to form ethylene.

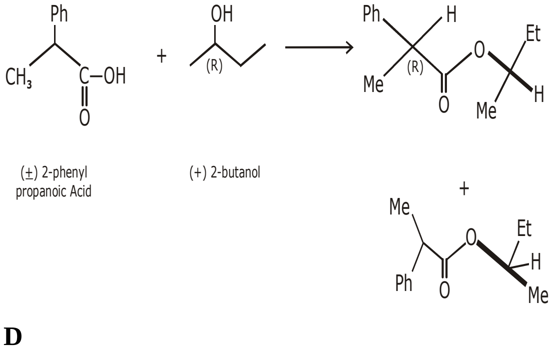
Q.7 **D**



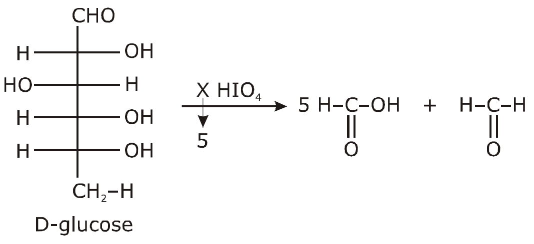
Q.8 **B**



Q.9 **A**

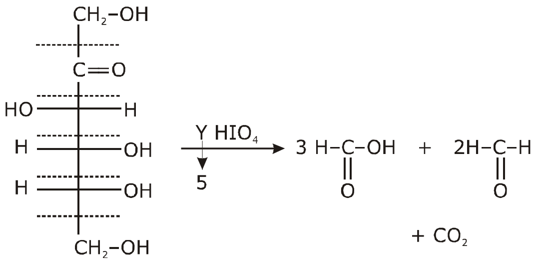


Q.10 **D**



Value of x ⇒ 5

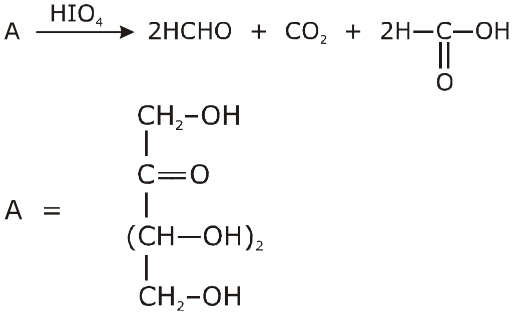
(ii) **C**



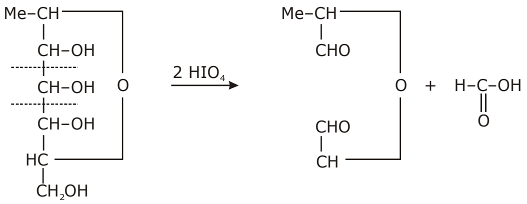
(iii) **A**

Total no. of HCHO in A = 1

Q.11 **C**



Q.12 **B**

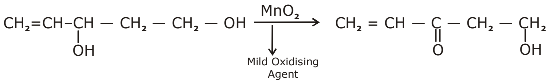


Q.13 **A**

$$CH_3-CH_2-CH_2-OH \xrightarrow{\text{oxidised}} CH_3-CH_2-COOH$$

(Primary alcohol)

Q.14 **A**



$$CH_2{=}CH-\underset{OH}{CH}-CH_2-CH_2-OH \xrightarrow[\text{Mild Oxidising Agent}]{MnO_2} CH_2=CH-\underset{O}{\overset{\|}{C}}-CH_2-\underset{OH}{CH_2}$$

Q.15 **B**

$$C_7H_{16}P_2 \xrightarrow{PCC,\ CH_2Cl_2} C_7H_{16}P_2$$

diol (chiral) diketone (Achiral)

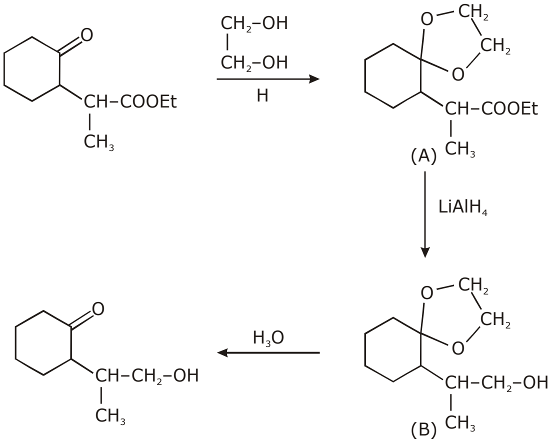
Q.16 **B**

$$1^{o}\text{ alcohol} \xrightarrow{\text{P.C.C. in } CH_2Cl_2} \text{aldehyde}$$

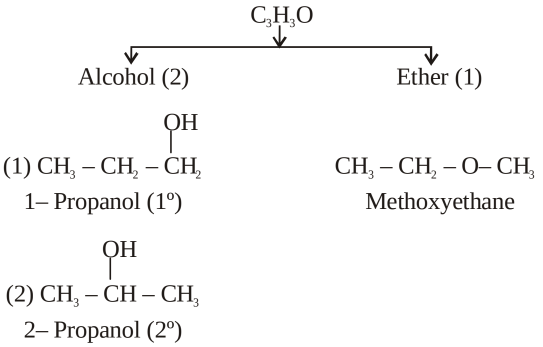
Mild oxidising agent

(sarette reagent)

Q.17 **B**



Q.18 **C**



C_3H_3O

Alcohol (2) Ether (1)

(1) $CH_3-CH_2-\overset{\overset{OH}{|}}{CH_2}$

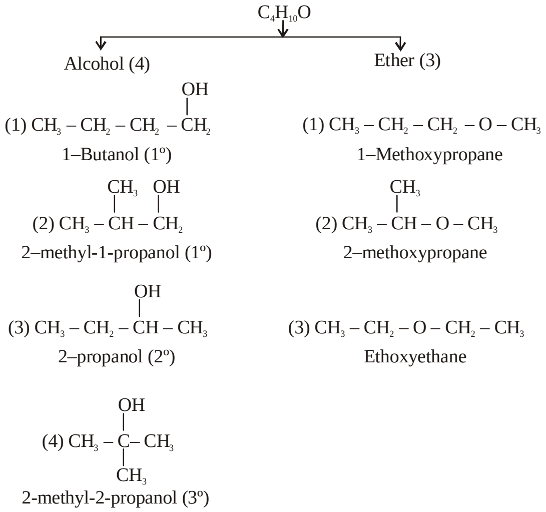
1– Propanol (1º)

$CH_3-CH_2-O-CH_3$

Methoxyethane

(2) $CH_3-\overset{\overset{OH}{|}}{CH}-CH_3$

2– Propanol (2º)



$C_4H_{10}O$

Alcohol (4) Ether (3)

(1) $CH_3-CH_2-CH_2-\overset{\overset{OH}{|}}{CH_2}$

1–Butanol (1º)

(2) $CH_3-\overset{\overset{CH_3}{|}}{CH}-\overset{\overset{OH}{|}}{CH_2}$

2-methyl-1-propanol (1º)

(3) $CH_3-CH_2-\overset{\overset{OH}{|}}{CH}-CH_3$

2–propanol (2º)

(4) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$

2-methyl-2-propanol (3º)

(1) $CH_3-CH_2-CH_2-O-CH_3$

1–Methoxypropane

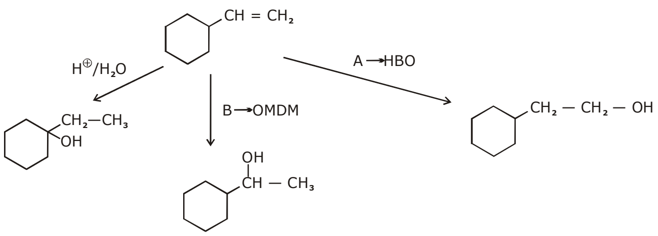
(2) $CH_3-\overset{\overset{CH_3}{|}}{CH}-O-CH_3$

2–methoxypropane

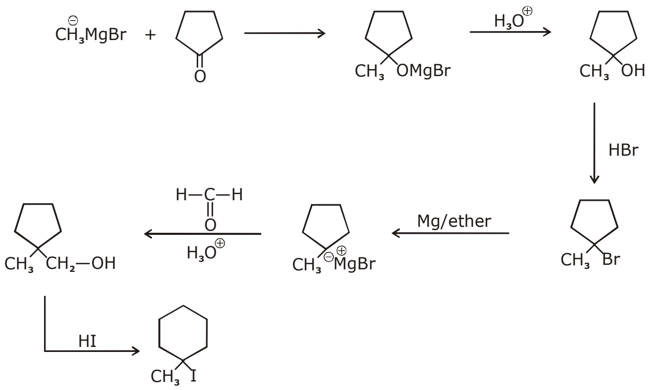
(3) $CH_3-CH_2-O-CH_2-CH_3$

Ethoxyethane

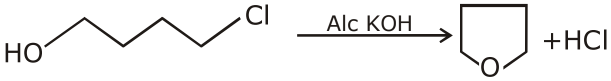
Q.19 **C**



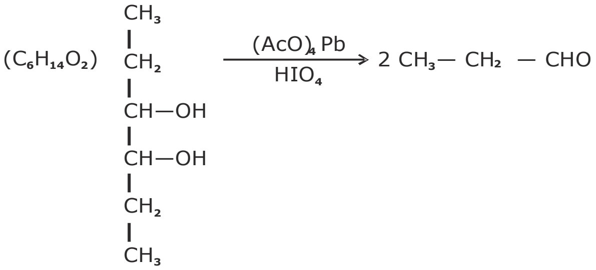
Q.20 **D**



Q.21 **D**

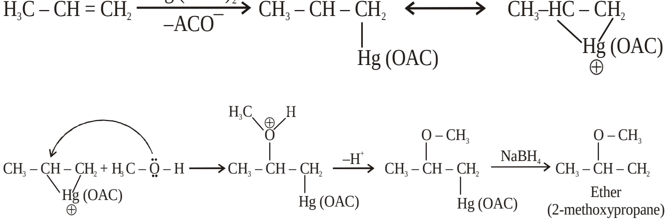


Q.22 **D**



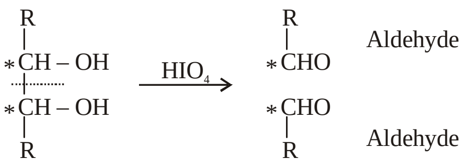
Q.23 B

It is oxymercuration & demercuration reaction.

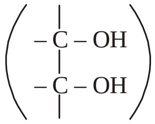


Q.24 (C)

Malapharad oxidation

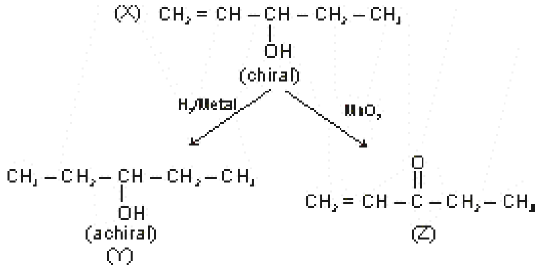


Number of HIO_4 required are equal to total number of viccinal diol group

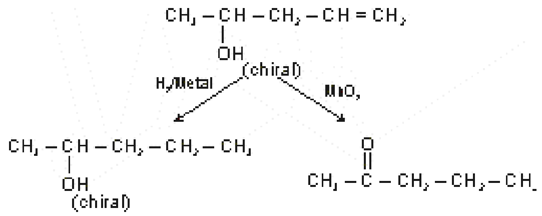


Q.25 (A)

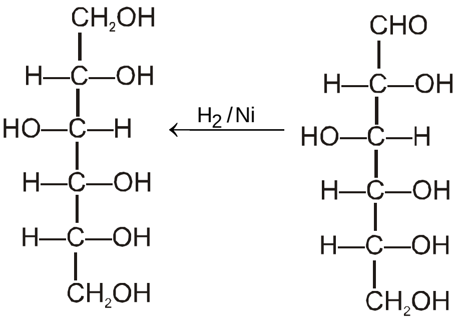
(a)



(b)



Q.26 (D)



$\xrightarrow{P+HI} C_6H_{14}$ (n-Hexane)

Q.27 (B)

Oppenauer's oxidation, oxidised secondary alcohol into ketone and there is no effect on double bond.

Q.28 (C)

Acidic $KMnO_4$ breaks the double bond and also oxidises 2º alcohol to ketone, whereas PCC only oxidises 2º alcohol to ketone. So the answer is (C).

Q.29 (D)

Only primary and secondary alcohols will be able to change the colour as they will be easily oxidised by CrO_3 / aq. H_2SO_4.

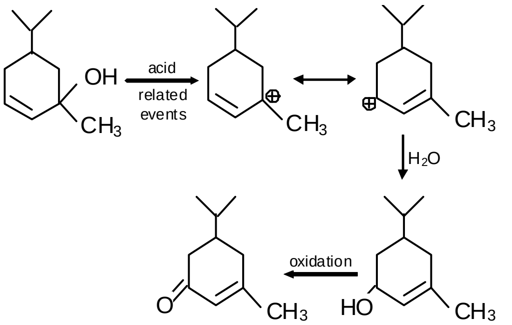
Q.30 (D)

Q.31 (C)

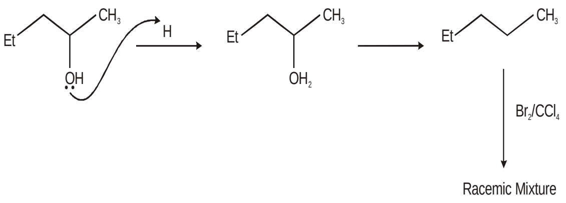
Q.32 (B)

Q.33 (B)

Rearrangement of 3º allylic alcohol.



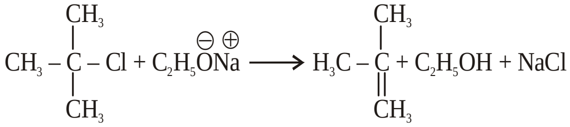
Q.34 (B)



Q.35 D

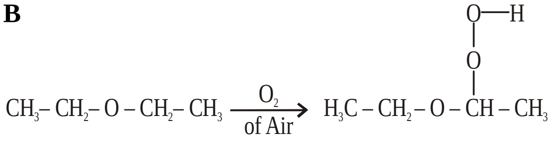
$C_2H_5OC_2H_5 \xrightarrow{\text{Oxygen}}$ Ether peroxide

Q.36 B



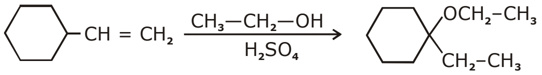
$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Cl + C_2H_5\overset{\ominus\,\oplus}{O}Na \longrightarrow H_3C-\overset{CH_3}{\underset{\overset{\|}{CH_3}}{C}} + C_2H_5OH + NaCl$

Q.37 B

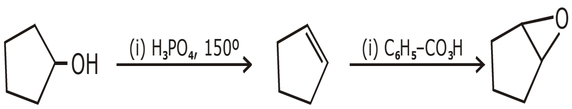


$CH_3-CH_2-O-CH_2-CH_3 \xrightarrow[\text{of Air}]{O_2} H_3C-CH_2-O-\overset{O-H}{\overset{|}{\overset{O}{\overset{|}{CH}}}}-CH_3$

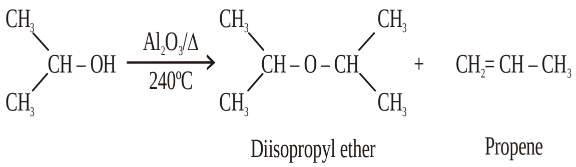
Q.38 A



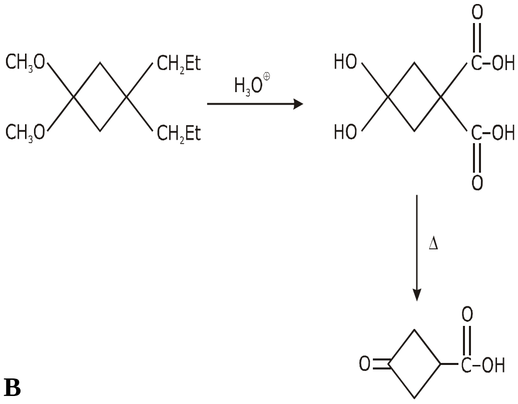
Q.39 D



Q.40 **C**



Q.41 **B**

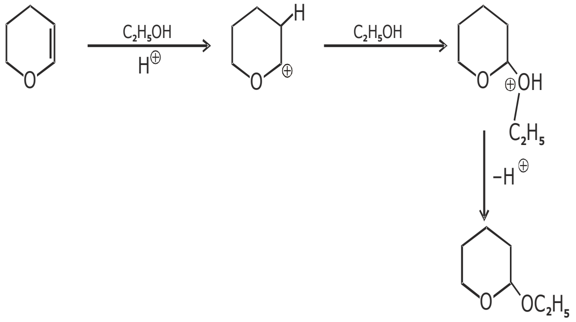


Q.42 **B**

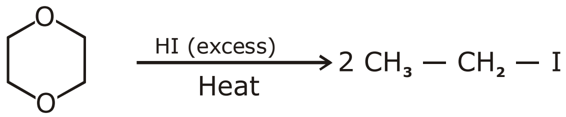
$$CH_3-CH_2-O-CH_2-CH_3 \xrightarrow[\text{Sun light}]{Cl_2} CCl_3-CCl_2-O-CCl_2-CCl_3$$

Q.43 **C**

Q.44 **B**

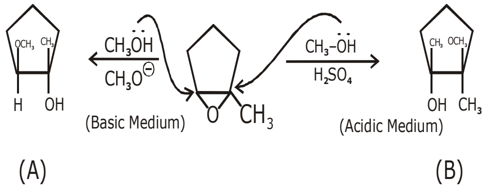


Q.45 **A**

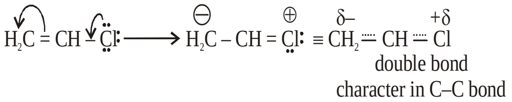


Q.46 **A**

Q.47 **B**



Q.48 **D**

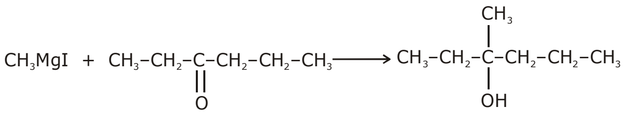


Due to resonance in vinyl chloride C–Cl bond acquire double bond character so does not break by $\overset{\oplus}{Na}\overset{\ominus}{OMe}$]

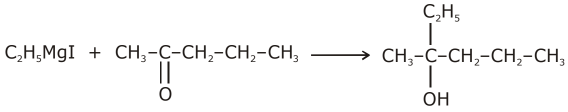
JEE-ADVANCED

MCQ/COMPREHENSION/COLUMN MATCHING

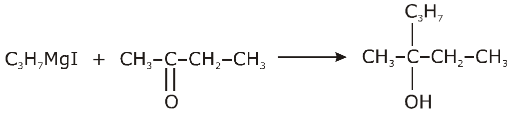
Q.1 (A,B,C)

A 

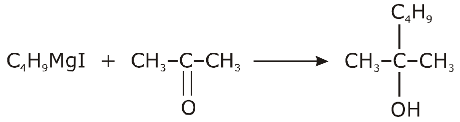
$$CH_3MgI + CH_3-CH_2-\underset{\underset{O}{\parallel}}{C}-CH_2-CH_2-CH_3 \longrightarrow CH_3-CH_2-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_2-CH_2-CH_3$$

B 

$$C_2H_5MgI + CH_3-\underset{\underset{O}{\parallel}}{C}-CH_2-CH_2-CH_3 \longrightarrow CH_3-\overset{\overset{C_2H_5}{|}}{\underset{\underset{OH}{|}}{C}}-CH_2-CH_2-CH_3$$

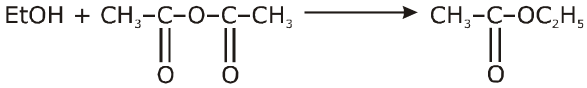
C 

$$C_3H_7MgI + CH_3-\underset{\underset{O}{\parallel}}{C}-CH_2-CH_3 \longrightarrow CH_3-\overset{\overset{C_3H_7}{|}}{\underset{\underset{OH}{|}}{C}}-CH_2-CH_3$$

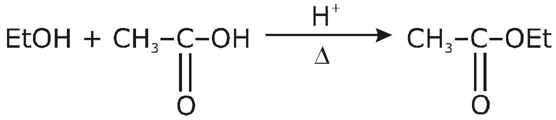
D 

$$C_4H_9MgI + CH_3-\underset{\underset{O}{\parallel}}{C}-CH_3 \longrightarrow CH_3-\overset{\overset{C_4H_9}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$$

Q.2 (A,B,C)



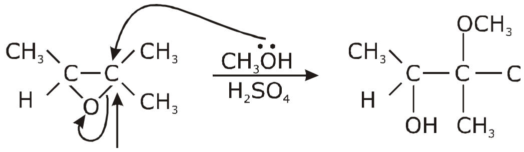
$$EtOH + CH_3-\underset{\underset{O}{\parallel}}{C}-O-\underset{\underset{O}{\parallel}}{C}-CH_3 \longrightarrow CH_3-\underset{\underset{O}{\parallel}}{C}-OC_2H_5$$

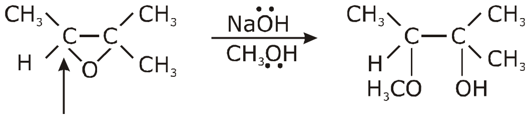


$$EtOH + CH_3-\underset{\underset{O}{\parallel}}{C}-OH \xrightarrow[\Delta]{H^+} CH_3-\underset{\underset{O}{\parallel}}{C}-OEt$$

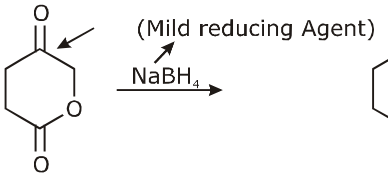
$$EtOH + CH_3-\underset{\underset{O}{\parallel}}{C}-Cl \longrightarrow CH_3-\underset{\underset{O}{\parallel}}{C}-OEt$$

Q.3 (A,C,D)

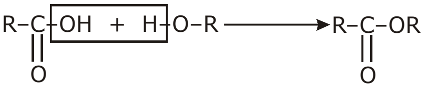
A 

B 

C

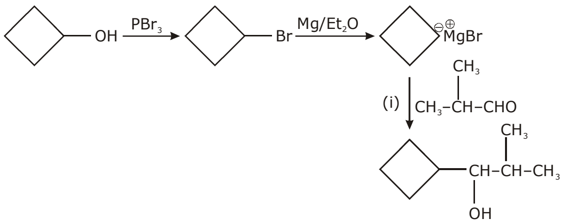


D



$R{-}\underset{\|\atop O}{C}{-}\boxed{OH + H}{-}O{-}R \longrightarrow R{-}\underset{\|\atop O}{C}{-}OR$

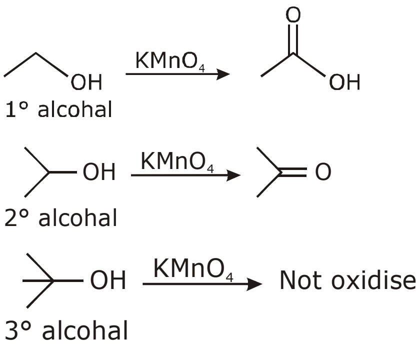
Q.4 (A,B,C)



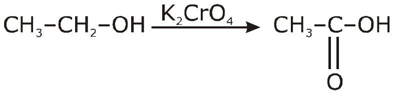
Q.5 (B)

β- hydroxy carbonyl and cis 1-2, diol can be cleave by HIO_4.

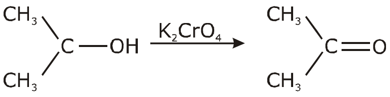
Q.6 (B,D)

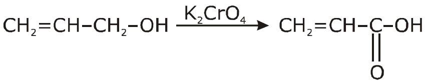


Q.7 (A,C,D)



$CH_3{-}CH_2{-}OH \xrightarrow{K_2CrO_4} CH_3{-}\underset{\|\atop O}{C}{-}OH$





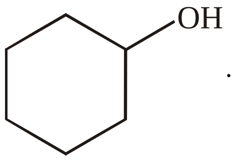
$CH_2{=}CH{-}CH_2{-}OH \xrightarrow{K_2CrO_4} CH_2{=}CH{-}\underset{\|\atop O}{C}{-}OH$

Q.8 (A,B,D)

– Electrophilic addition reaction.

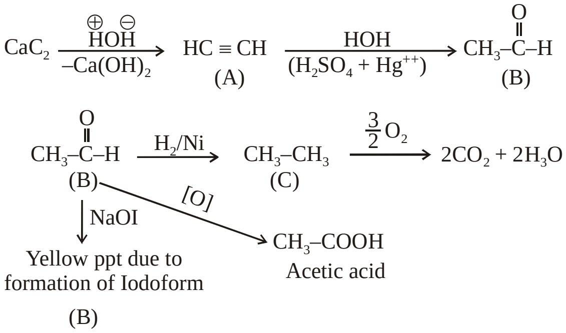
– Acid catalysed Hydration will give rearrange product.

– In cyclohexene reaction occur in either HBO or oxymercuration – demeruiration or acid catalysed hydrolysis product is always cyclohexanol



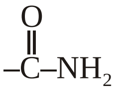
Sol. – Compound A is unsaturated.

– Compound A is alkyne.



Q.10 (A,,C,D)

– Alcohols have –OH group.



– Amide ($-\overset{O\atop\|}{C}{-}NH_2$) does not give alcohol on reduction.

Q.11 (A,B,C)

– Electrophilic addition reaction, oxidation & SN–Rxn

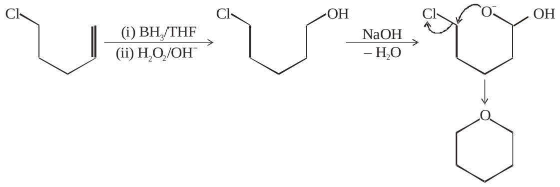
A → HBO

B → Oxymeruration Demercuration

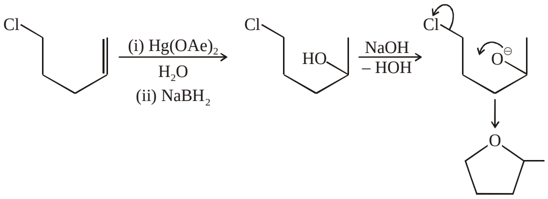
C → Epoxidation

D → SN–Reaction of aromatic compound.

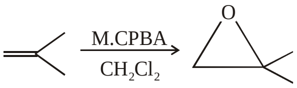
(A)

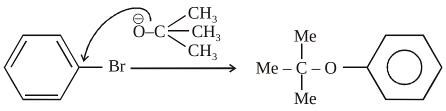


(B)



(C)



(D) 

double bond charecter in C–Br bond so does not break easily

Does not formed

Q.12 (A,B,C,D)

– Tilden Reagent is NOCl.

– Conversion of (II) → (III) in value diazzolization.

$$\begin{tikzcd} C_2H_5\text{–}NH_2 \arrow[r, "NOCl", "\text{Tilden Reagent}"'] & \underset{(i)}{R\text{–}Cl} \arrow[r, "NH_3"] & \underset{(ii)}{R\text{–}NH_2} \arrow[d, "(NaNO_2 + HCl)"] \\ & R^{\oplus} + N_2(\uparrow) + Cl^{\ominus} & {[R\text{–}\overset{\oplus}{N}\equiv N]} \arrow[l] \end{tikzcd}$$

$R^{\oplus} + Cl^{\ominus} \rightarrow R\text{–}Cl$ (Alkyl chloride)

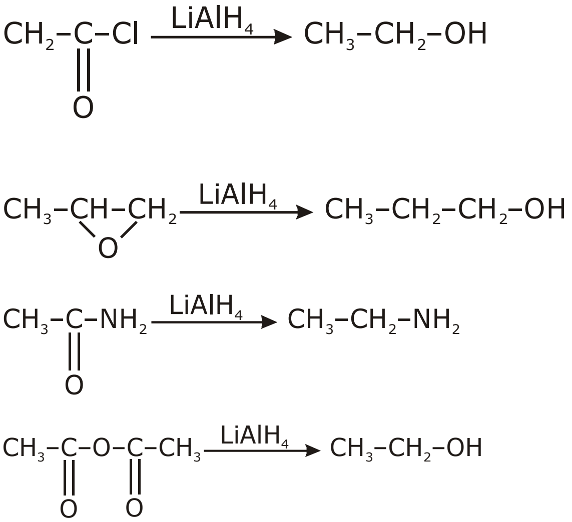
$R^{\oplus} + HOH \rightarrow R\text{–}Cl$ (Alcohol)

$R^{\oplus} + ROH \rightarrow R\text{–}O\text{–}R$ (Ether)

$R^{\oplus} + \overset{\ominus}{NO_2} \rightarrow R\text{–}NO_2$ (reaction)

(where – R = $–C_2H_5$ in above)

Q.13 (A,C,D)



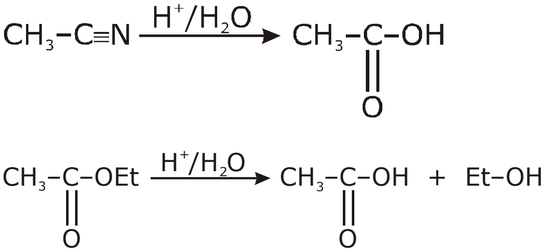
$$CH_2\text{–}\underset{\underset{O}{\|}}{C}\text{–}Cl \xrightarrow{LiAlH_4} CH_3\text{–}CH_2\text{–}OH$$

$$CH_3\text{–}\underbrace{CH\text{–}CH_2}_{O} \xrightarrow{LiAlH_4} CH_3\text{–}CH_2\text{–}CH_2\text{–}OH$$

$$CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}NH_2 \xrightarrow{LiAlH_4} CH_3\text{–}CH_2\text{–}NH_2$$

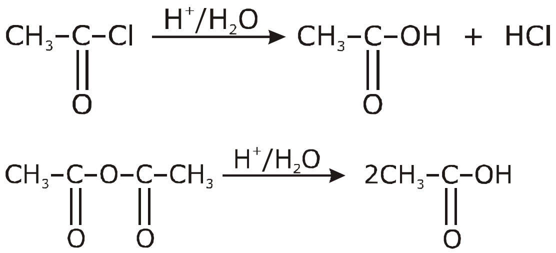
$$CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}O\text{–}\underset{\underset{O}{\|}}{C}\text{–}CH_3 \xrightarrow{LiAlH_4} CH_3\text{–}CH_2\text{–}OH$$

Q.14 (A,B,C,D)



$$CH_3\text{–}C\equiv N \xrightarrow{H^+/H_2O} CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}OH$$

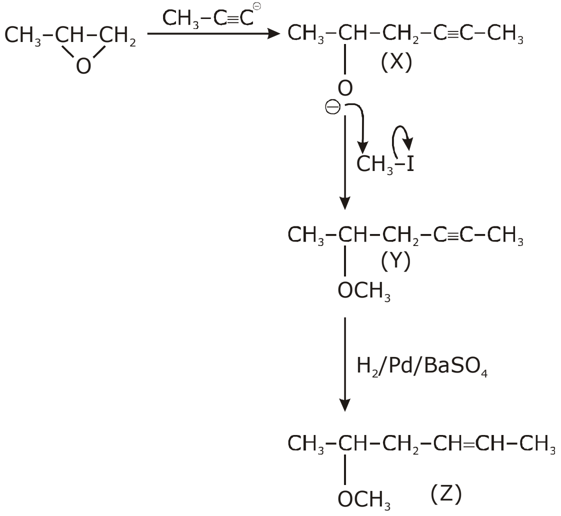
$$CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}OEt \xrightarrow{H^+/H_2O} CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}OH + Et\text{–}OH$$



$$CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}Cl \xrightarrow{H^+/H_2O} CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}OH + HCl$$

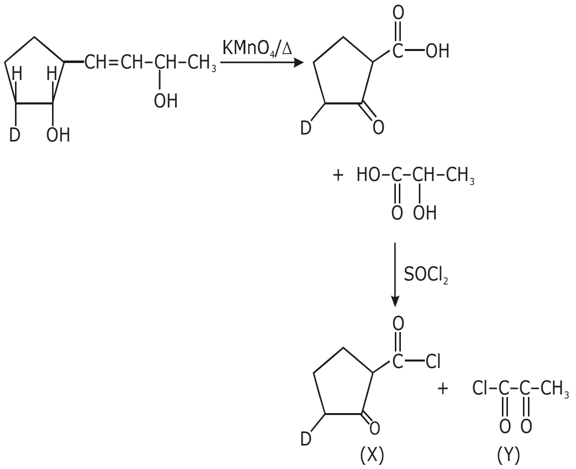
$$CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}O\text{–}\underset{\underset{O}{\|}}{C}\text{–}CH_3 \xrightarrow{H^+/H_2O} 2CH_3\text{–}\underset{\underset{O}{\|}}{C}\text{–}OH$$

Q.15 (A,C,D)

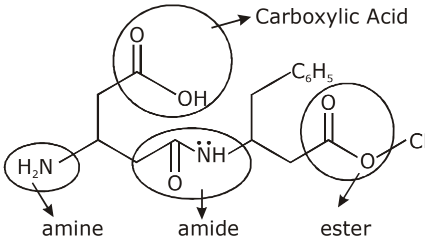


$$CH_3\text{–}\underbrace{CH\text{–}CH_2}_{O} \xrightarrow{CH_3\text{–}C\equiv C^{\ominus}} \underset{(X)}{CH_3\text{–}\underset{\underset{O^{\ominus}}{|}}{CH}\text{–}CH_2\text{–}C\equiv C\text{–}CH_3} \xrightarrow{CH_3\text{–}I} \underset{(Y)}{CH_3\text{–}\underset{\underset{OCH_3}{|}}{CH}\text{–}CH_2\text{–}C\equiv C\text{–}CH_3} \xrightarrow{H_2/Pd/BaSO_4} \underset{(Z)}{CH_3\text{–}\underset{\underset{OCH_3}{|}}{CH}\text{–}CH_2\text{–}CH{=}CH\text{–}CH_3}$$

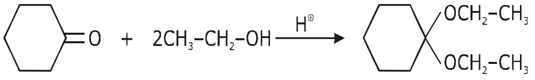
Q.16 (B,D)



Q.17 (A,D)

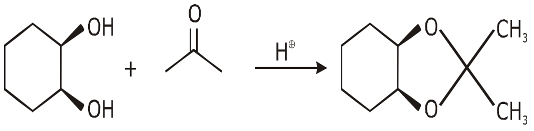


Q.18 (B)



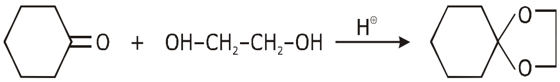
(P)

Q.19 (B)



(Q)

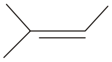
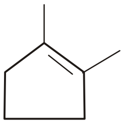
Q.20 (B)



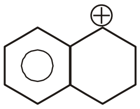
(R)

Q.21 (D)
E' reaction favoured at high T & removal of alkene; Equilibrium reaction, forced in forward direction by removal of alkene; Le-chatlier's principle

Q.22 (D)

in (A)  α n = 9 and in (B)  α H = 10
Total α n = 19]

Q.23 (A)

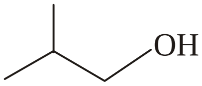
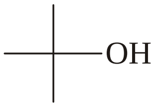
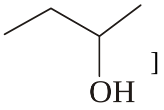
Stability of carbocation formed;  ;

Resonance stabilised.]

Q.24 (C)

Q.25 (D)

Q.26 (D)

X = 
Y = 
Z = ]

Q.27 (D)
Q.28 (C)

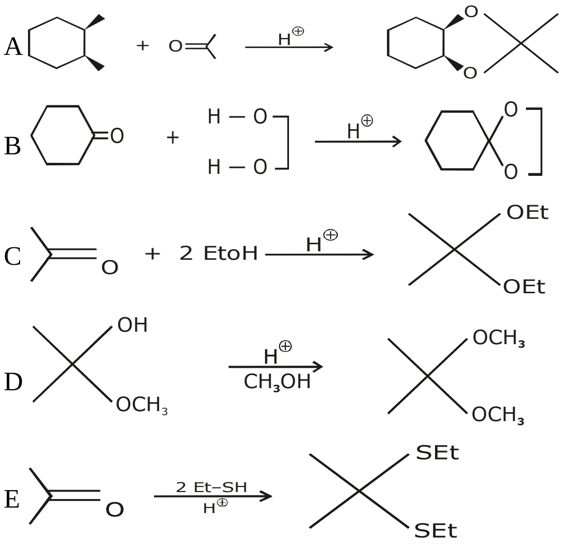
Q.29 (A)
Q.30 (A)
Q.31 (D)

Q.32 (A)

Q.33 A → P; B → Q,R; C → S

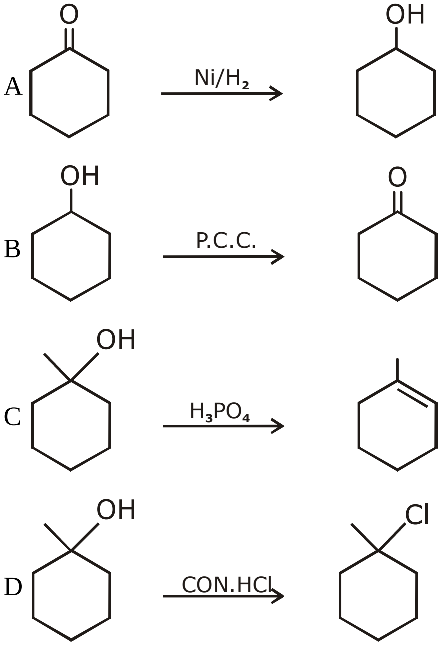
Q.34 (A) P, R, S; (B) Q, S; (C) T; (D) P, R, S]

Q.35 A–P,S; B–P,S; C–P,S; D–R,S; E–R



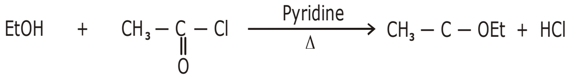
Q.36 (A) P (B) Q (C) R

Q.37 A–P; B–Q; C–R; D–S



Q.38 (A) Q, S; (B) Q, S; (C) P, R, T (D) P, R, T

Q.39 A–P,R,Q; B–P,R,Q; C–P,R,Q; D–S

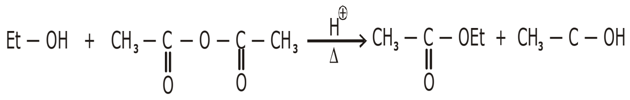
A 

$$EtOH + CH_3-\underset{\|}{\overset{}{C}}(=O)-Cl \xrightarrow[\Delta]{Pyridine} CH_3-C(=O)-OEt + HCl$$

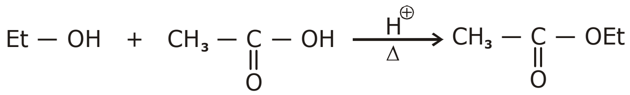
Esterification Reaction

Acetylation Reaction

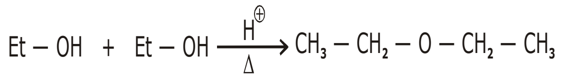
M.F. of alcohol increase by C_2H_2O

B 

$$Et-OH + CH_3-C(=O)-O-C(=O)-CH_3 \xrightarrow[\Delta]{H^{\oplus}} CH_3-C(=O)-OEt + CH_3-C(=O)-OH$$

C 

$$Et-OH + CH_3-C(=O)-OH \xrightarrow[\Delta]{H^{\oplus}} CH_3-C(=O)-OEt$$

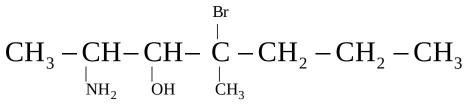
D 

$$Et-OH + Et-OH \xrightarrow[\Delta]{H^{\oplus}} CH_3-CH_2-O-CH_2-CH_3$$

M.F of alcohol increase by 2.8

NUMERICAL VALUE BASED

Q.1 [8]



$$CH_3-\underset{NH_2}{CH}-\underset{OH}{CH}-\overset{Br}{\underset{CH_3}{C}}-CH_2-CH_2-CH_3$$

number of chiral carbon is 3

⇒ optical isomer = $2^3 = 8$.

Q.2 [2]

Q.3 [3]

Q.4 [1]

(Only reaction with HBr form carbocation)

Q.5 [1]

(1) $C_2H_5OH \xrightarrow[Iodoform Test]{NaOH/I_2} CHI_3$ (yellow ppt)

$CH_3OH \xrightarrow{NOH/I_2}$ No. ppt.

Q.6 [2]

Q.7 [2]

Q.8 [4]

The compound does not react with Na, thus it is not an alcohol. It is saturated, as it does not add up Br_2. With excess of HI produces only one iodide, thus it is a symmetrical ether.

$$\underset{(X)}{R-O-R} \xrightarrow{2HI} \underset{(Y)}{2RI} + H_2O$$

$$\underset{(Y)}{RI} \xrightarrow{Hydrolysis} \underset{(Z)}{R-OH} \xrightarrow{Oxidation} Acid\left(CH_3COOH\right)$$

Hence

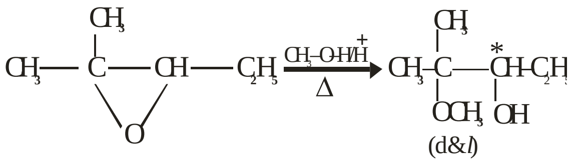
R – OH (Z) is C_2H_5OH

R I (Y) is C_2H_5I

R – O – R (X) is $C_2H_5-O-C_2H_5$

(X) Contains 4 carbon atoms.

Q.9 [2]



Q.10 [2]

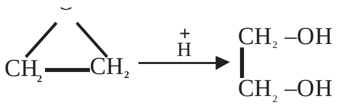
In water only ethanol will dissolve. With Na, only C_2H_5OH will liberate H_2 gas.

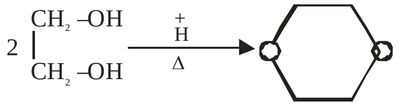
These observation are absent with diethyl ether.

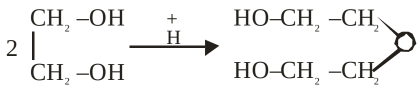
With hot PCl_5 both will produce C_2H_5Cl

So, water and sodium can be used for distinguishing C_2H_5OH and $C_2H_5OC_2H_5$.

Q.11 [3]

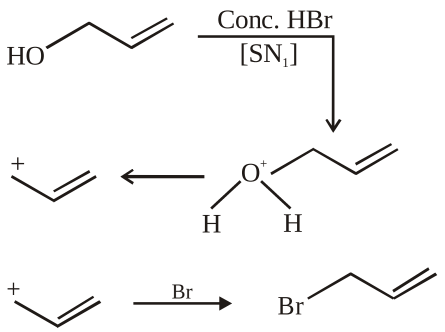






KVPY
PREVIOUS YEAR'S

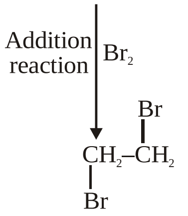
Q.1 (2)



Q.2 (1)

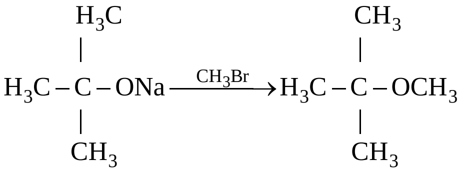
$$CH_3-CH_2-OH \xrightarrow[\substack{-H_2O\\ \text{Dehydration of Alcohol}}]{Conc.H_2SO_4} CH_2=CH_2$$

Ethene (gas)



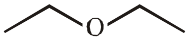
1, 2 dibromo ethane

Q.3 (2)

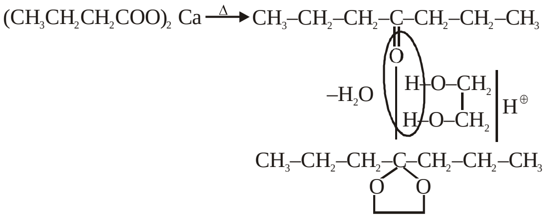


$$H_3C-\underset{CH_3}{\overset{H_3C}{\underset{|}{\overset{|}{C}}}}-ONa \xrightarrow{CH_3Br} H_3C-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-OCH_3$$

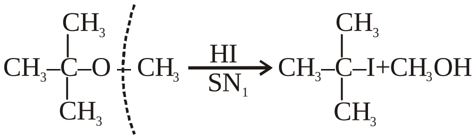
Q.4 (C)

Alcohol forms hydrogen bonding so their boiling point is higher. Ether can not form H bond so its boilling point is lowest ∴  Have lowest boiling point.

Q.5 (A)



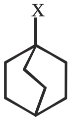
Q.6 (C)



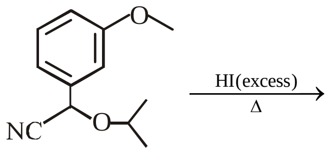
$$CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-O-CH_3 \xrightarrow[SN_1]{HI} CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-I+CH_3OH$$

If one of the alkyl group is 3º. Then mechanism is SN_1 and nucleophile attach to the carbon where carbocation is more stable.

Q.7 (B)

Here I is the better leaving group and the substitution can not occur at bridgehead carbon 

Q.8 (1)

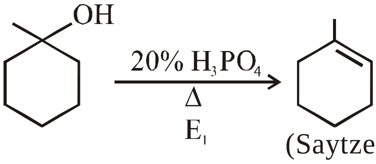


Phenolic –OH does not react with HI and benzylic –O– having –CN attached will react with HI by S_N2 mechanism.

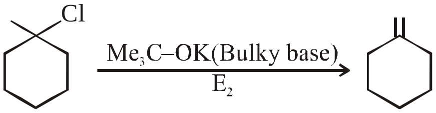
JEE-MAINS PREVIOUS YEAR'S

Q.1 (1)

Q.2 (3)



(Saytzeff product)

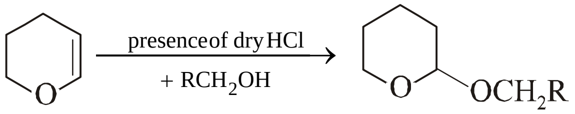


(Hoffmann product)

Q.3 (2)
Q.4 (3)
Q.5 (2)
Q.6 (4)
Q.7 (3)
Q.8 (3)
Q.9 **(2)**
Q.10 **(1)**

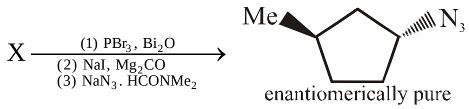
JEE-ADVANCED PREVIOUS YEAR'S

Q.1 (B)

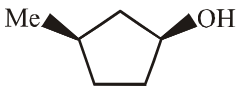


(An acetal)

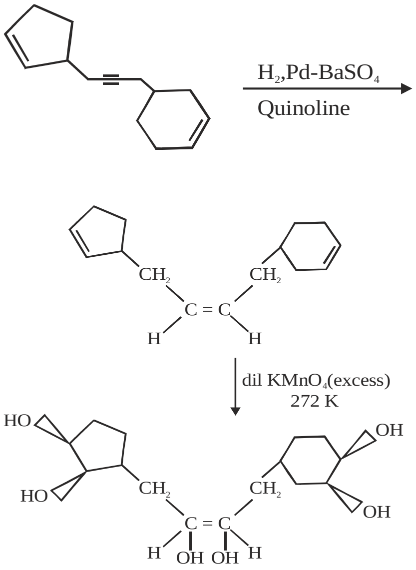
Q.2 (B)



All the three reaction are N_N2 so X is



Q.3 (6.00)



total 6 – OH group present in a molecule of the major product.

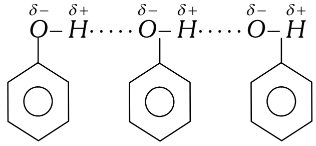
Phenol

EXERCISES

ELEMENTARY

Q.1 (3)

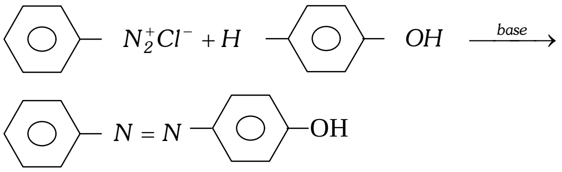
Q.2 (2)



Q.3 **(1)**

Q.4 (4)

Q.5 (1)



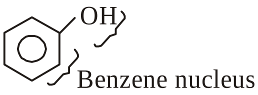
p-hydroxy azobenzene
(orange dye)
This is an example of coupling reaction

Q.6 **(4)**

Q.7 (1)
Correct order of dehydration in alcohols 3° > 2° > 1°.

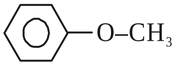
JEE-MAIN
OBJECTIVE QUESTIONS

Q.1 **(2)**



Q.2 **(1)**

Q.3 **(3)**



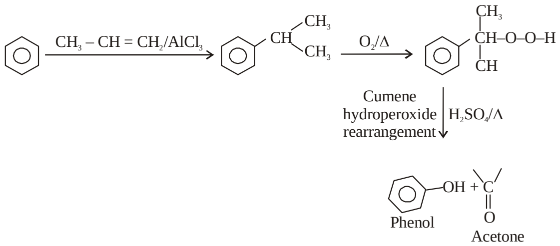
Methoxybenzene
(Anisol)

Q.4 **(3)**
Electron in π bonds are π electrons & lone pair electrons which delocalises in the process of resonance are also counted as π electrons.

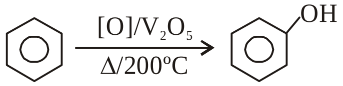
Q.5 **(2)**

Due to presence of polar $(-\overset{\delta-}{O}-\overset{\delta+}{H})$ bond phenol can form hydrogen bond.

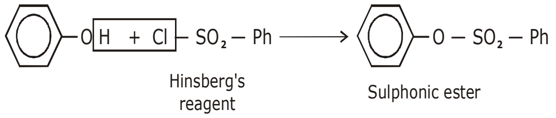
Q.6 **(2)**
Q.7 **(4)**
Q.8 (2)



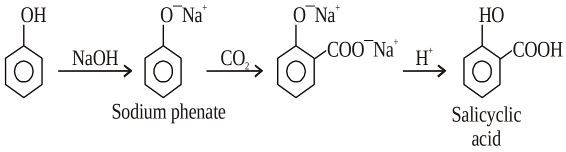
Q.9 (4)
Q.10 (4)
Q.11 (1)
Q.12 (3)



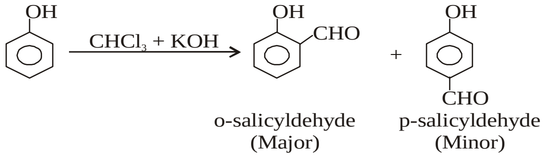
Q.13 **(3)**



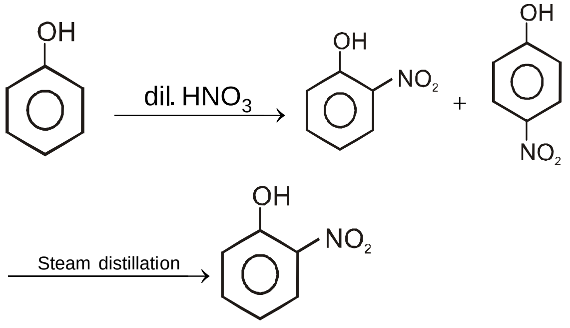
Q.14 **(3)**



Q.15 **(3)**
Reimer-Tiemann reaction



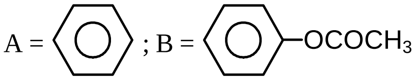
Q.16 **(4)**



[X] [Y]
[Low B.P.due to intramolecular H–Bonding]

Q.17 **(1)**

Q.18 **(2)**



Q.19 **(1)**

$NaHCO_3$ does not give effervescence with phenol. But ortho-para nitro phenols give effervescence with $NaHCO_3$.

Q.20 **(3)**

Chlorobenzene has π bond in aromatic ring.

Q.21 **(2)**

Salicylic acid on treatment with bromine water give 2,4,6-tribromophenol.

Q.22 **(1)**

Salicydehyde is *o*-hydroxybenzaldehyde. It is volatile as it has intramolecular hydrogen bonding.

Q.23 **(4)**

Due to intramolecular hydrogen bond (chelation) boiling point of o-nitrophenol is less than p-nitrophenol. So they can be separated by distillation.

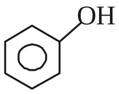
Q.24 **(1)**

Electron with drawing (–m/–R) nature of $–NO_2$ group increases acidic nature of p-nitrophenol.

Q.25 **(4)**

JEE-ADVANCED OBJECTIVE QUESTIONS

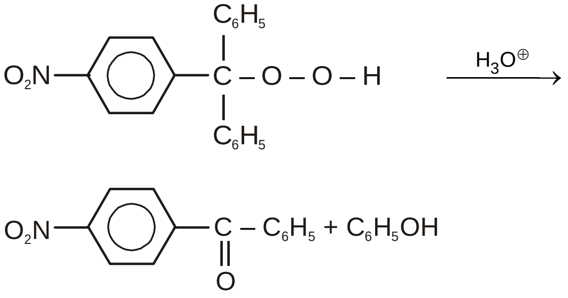
Q.1 (B)



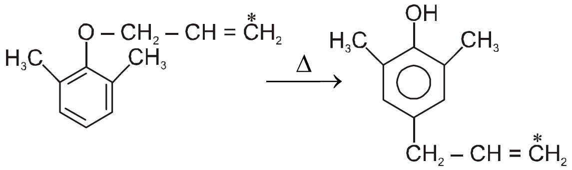
Phenol

(Not hydroxybenzene)

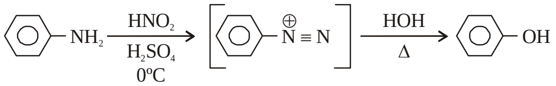
Q.2 (C)



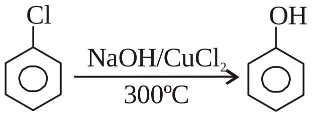
Q.3 (A)



Q.4 (D)



Q.5 (A)

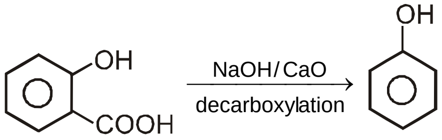


(Dow's proces)

Q.6 (D)

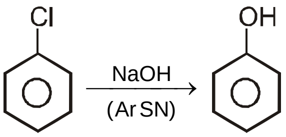
Q.7 (B)

(A)

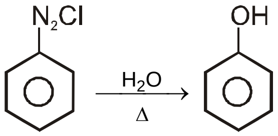


(B) $C_6H_5\,MgBr \xrightarrow{H_3O^+} C_6H_6 + Mg\begin{smallmatrix}Br\\OH\end{smallmatrix}$

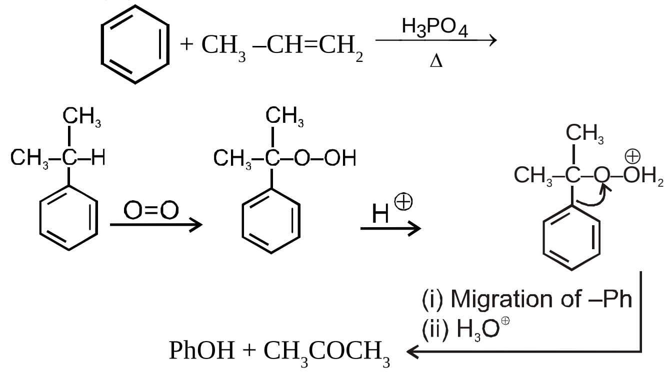
(C)



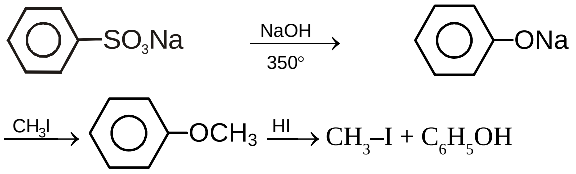
(D)



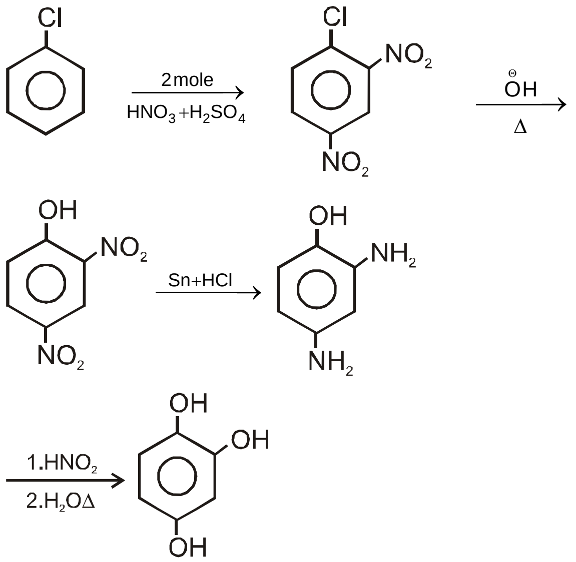
Q.8 (D)



Q.9 (C)

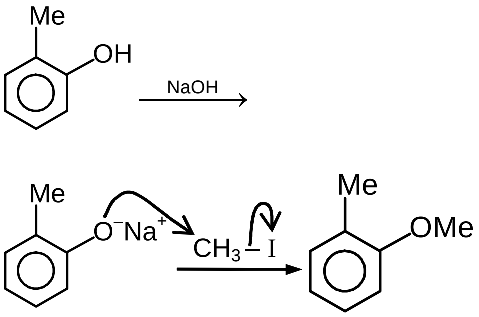


Q.10 (A)



Q.11 (C)

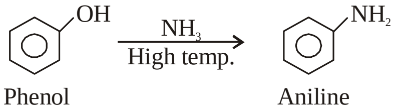
Q.12 (C)



Q.13 (D)

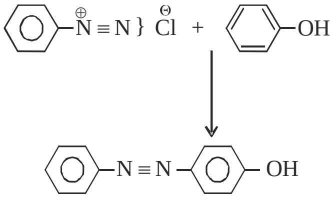
See Reimer - Tiemann reaction.

Q.14 (C)



Q.15 (C)

Q.16 (D)



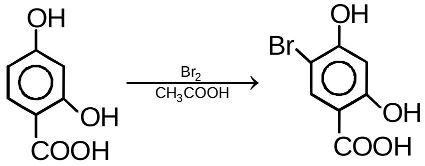
p-hydroxyazobenzene

Q.17 (C)

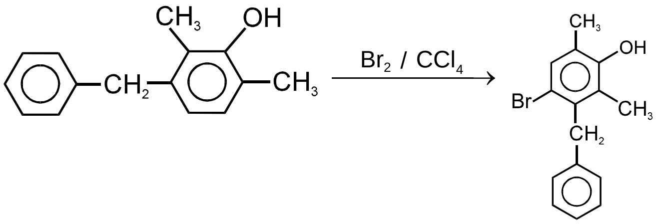
It is an example of alkylation of phenol.

Q.18 (B)

If bromine in acetic acid is used, bromination takes place without decarboxylation.



Q.19 (B)

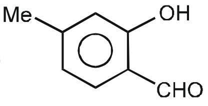


Q.20 (D)

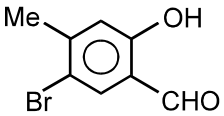
Electrophilic substitution reaction.

Q.21 (C)

(X)



(Y)



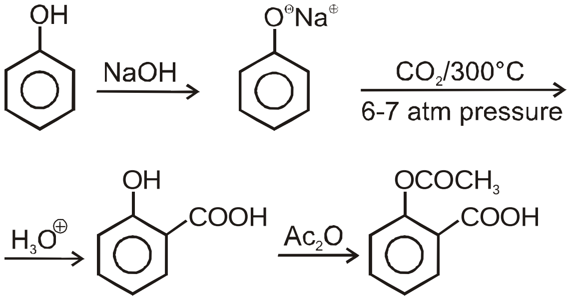
Attack will take place on the ring which is more electron rich. Benzene with –OH group attached is more elecron rich.

Q.22 (A)

Q.23 (A)

Orientation decided by more activating –OH group [+ M effect].

Q.24 (A)



Q.25 (B)

Q.26 (C)
Acidic nature of o-nitrophenol is less than H_2CO_3. SO it does not react with Na_2CO_3 solution.

Q.27 (C)

Due to high acidic nature, 2, 4, 6-trinitro phenol (picric acid) gives efferevescence with $NaHCO_3$.

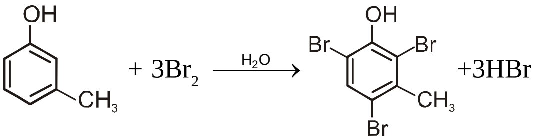
Q.28 (A)

Due to more acidic nature of benzoic acid, benzoic acid show efferevecense due to release of CO_2 (↑) from $NaHCO_3$.

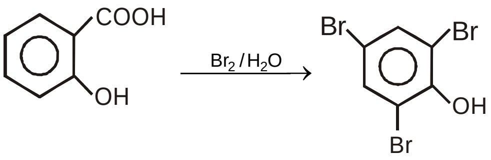
Q.29 (D)

Salicylic acid undergoes decarboxylation with the formation of 2,4,6-tribromophenol when treated with bromine water. The displacement of carboxyl group occurs only when the reaction is carried out in aqueous solution.

Q.30 (B)

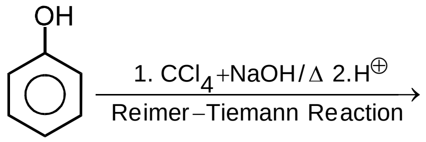


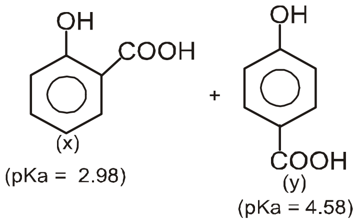
Q.31 (C)



Q.32 (D)

(D)





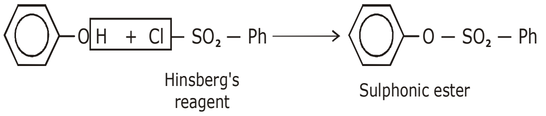
(Ka) = x > y (Carboxylate anion stabilized By H-bonding)
(Sol.) = y > x (Intermolecular H-bonding in y)
(Vol.) = x > y (Intramolecular H-bonding in x)
(MP) = y > x (More symmetrical structure of y)

Q.33 (B)

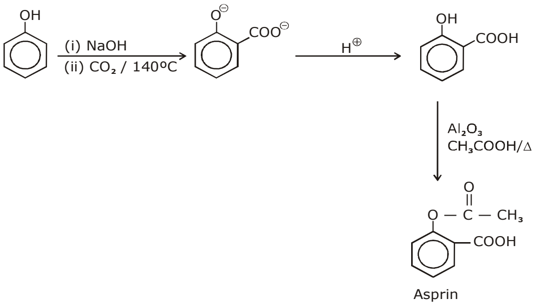
Q.34 (A)
Acidic nature of Ph-COOH is more than Ph–OH than because the stability of conjugate base of Ph-COOH is more stable than Ph–OH and that Ph–OH is more than benzyl alcohol Ph–CH_2–OH.

Q.35 (C)

Q.36 **C**



Q.37 **D**

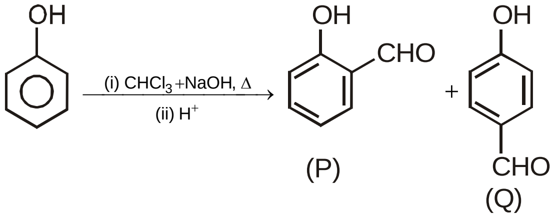


JEE-ADVANCED

MCQ/COMPREHENSION/COLUMN MATCHING

Q.1 (A,B)

Q.2 **(B,C)**

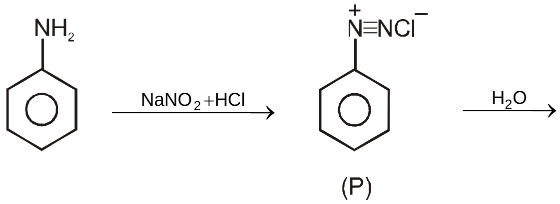


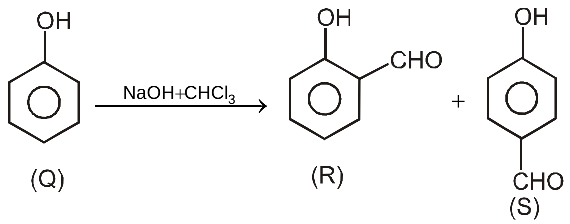
Q.3 Correct options for the given below reaction :

$$\text{Ph–OH} \xrightarrow[\text{(ii) } H^+]{\text{(i) } CHCl_3 + KOH} \text{Products}$$

All above reactions are correct. Reaction A is Koble Schmidt, B is Reimer-Tiemann reaction, C protection of phenolic group at Phenol and D is Laderer-Manase reaction.

Q.5 (A,C,D**)**



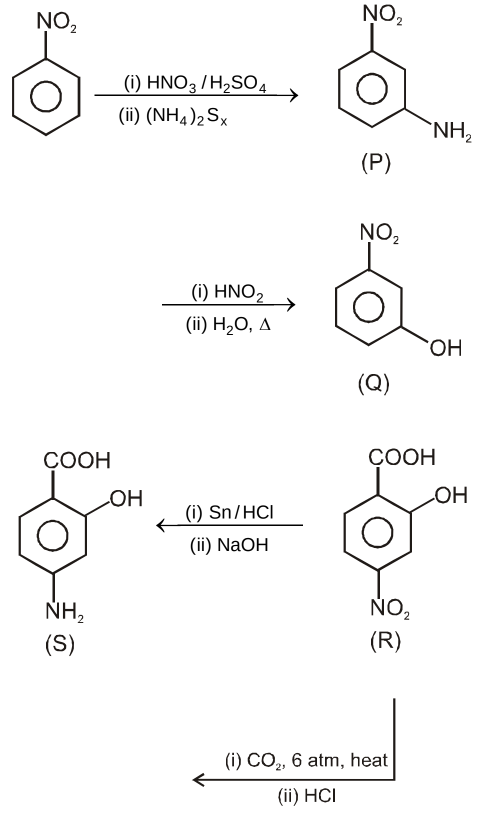


Phenol (Q) gives positive test with Br_2 water.

Q.6 (A,B,C)

Q.7 (A,B,C,D)
Q.8 (A,B,C,D)
All reactions are correct.

Q.9 (B,C,D)
Q.10 (B,D)

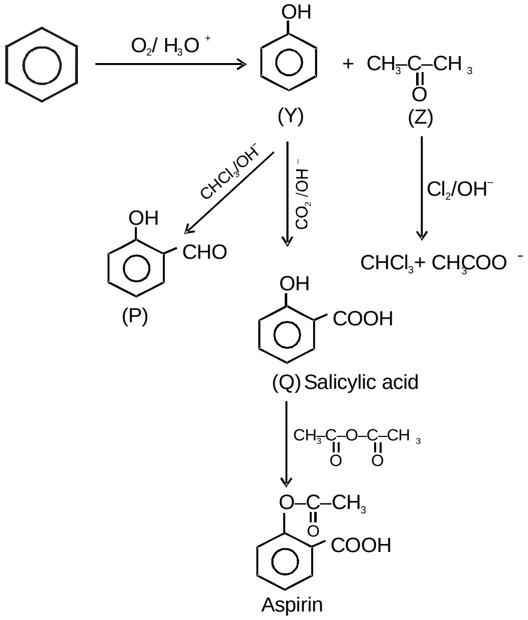


Q.11 (B,C,D)
Coupling reaction is shown by benzene diazonium chloride with more activated ring containining compounds. Benzaldehyde having deactivated ring.

Q.12 (C)
Q.13 (C)
Q.14 (B)

Q.15 **(C)**
Q.16 (B)

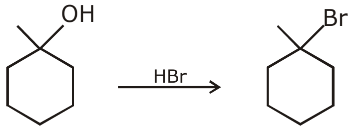
Q.17 **(A)**
(15 to 17)



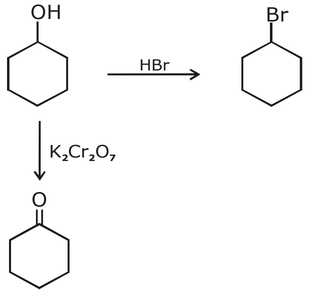
Q.18 (A) QS (B) S (C) Q (D) P

Q.19 (A) S, (B) Q, (C) P, (D) R
Q.20 (A) Q, (B) R, (C) S, (D) P
Q.21 (A) R, (B) S, (C) P, (D) Q
Q.22 (A)–R; (B)–R,S; (C)–P, R, T; (D)–Q

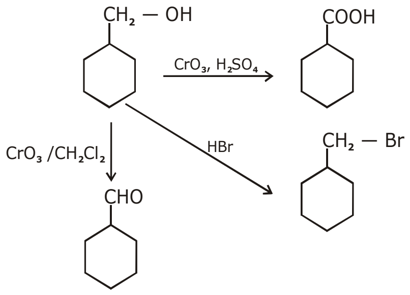
(A)



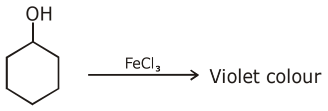
(B)



(B)

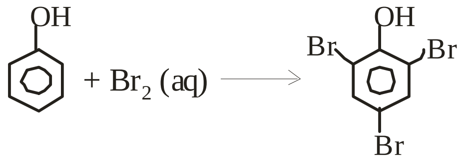


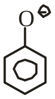
(D)



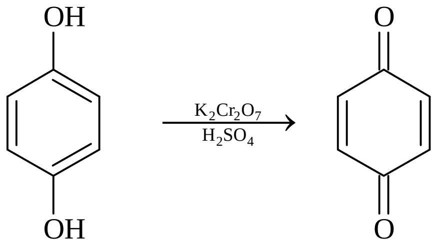
NUMERICAL VALUE BASED

Q.1 [3]

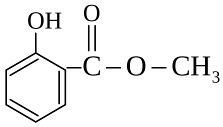


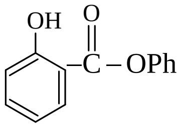
In presence of Br_2 water, phenol ionises to phenoxide in  which is a strong O– and p-directing group. So, both of ortho positions and para position will be brominated simultaneously consuming 3 equivalents of Br_2.

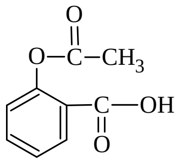
Q.2 [8]



Q.3 [4]

A – 

B – 

C – 

Q.4 [3]

Electron withdrawing group will increase the acidity of phenol.

NO_2 is EWG (-I, -R)

OCH_3 is EWG at metaposition (- I)

OCH_3 is electron donating group at para position (+R > - I)

Q.5 [3]

(I), (II) and (IV) are correct.

Electrophilic substitution is favoured by electron donating group and unfavoured by electron with drawing group.

- OH (+ R > - I)

- $CH_3(+R,+I)$ (+R) of – OH much stronger than - CH_3.

EWG increases acid strength of phenol whereas EDG decreases it.

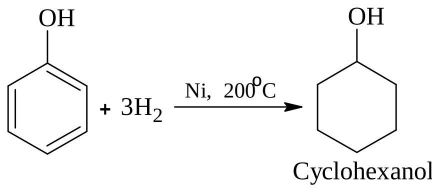
$-CH_3$ at meta position – (only + I)

$-CH_3$ at para position – (both + I and + R)

Reactivity with Na (1° alcohol > 2° > 3°)

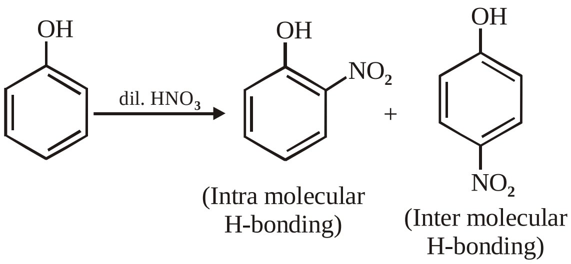
Ease of esterification (1° alcohol > 2° > 3°)

Q.6 [3]

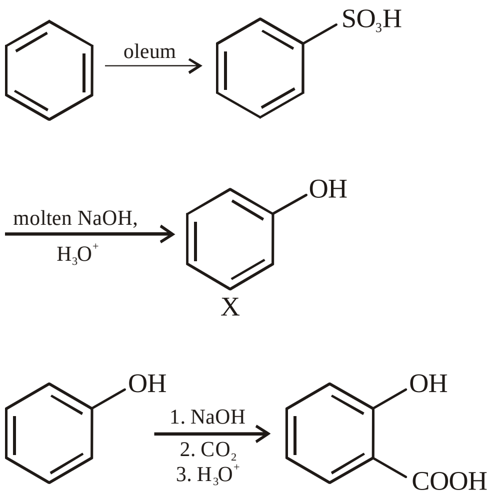


KVPY
PREVIOUS YEAR'S

Q.1 (1)

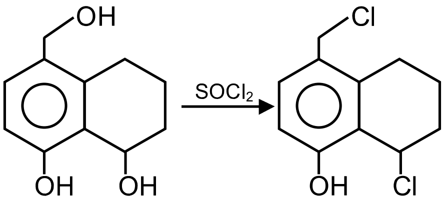


Q.2 **(D)**



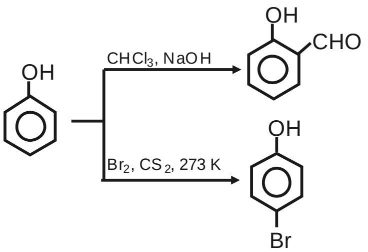
JEE-MAIN
PREVIOUS YEAR'S

Q.1 (3)



Phenolic OH group does not give substitution reaction as lone pair of oxygen is delocalised with benzene and double bond character in C–O bond.

Q.2 (2)

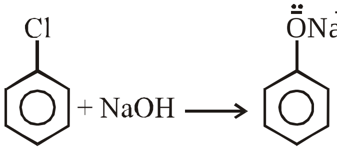


It is Reimer–Tiemann reaction

It is monobromination of phenol in non polar solvent

Q.3 (1)

Q.4 **(4)**



Dow process

Temperature = 623 K
Pressure = 300 atm

Q.5 (3)
Q.6 (3)
Q.7 (2)
Q.8 (2)
Q.9 **(4)**
Q.10 **(4)**

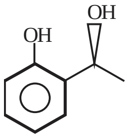
JEE-ADVANCED
PREVIOUS YEAR'S

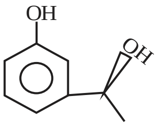
Q.1 (6)

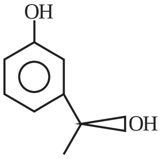
($C_8H_{10}O_2$) → Gives $FeCl_3$ test means Phenol derivative

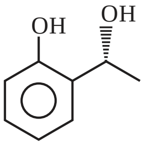
↓

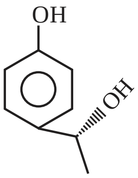
Rotate plane polarized light means optically active

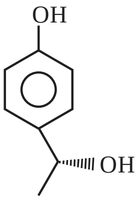










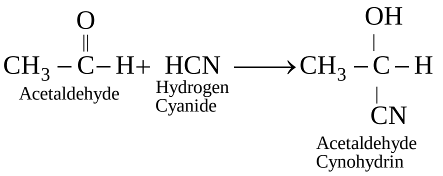


Aldehydes and Ketones (Carbonyl Compounds)

EXERCISES

ELEMENTARY

Q.1 (1)



$$\underset{\text{Acetaldehyde}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-H} + \underset{\text{Hydrogen Cyanide}}{HCN} \longrightarrow \underset{\text{Acetaldehyde Cynohydrin}}{CH_3-\overset{\overset{\displaystyle OH}{|}}{\underset{\underset{\displaystyle CN}{|}}{C}}-H}$$

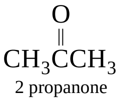
(optically active)

Q.2 (2)

$$\underset{sp^2\ \text{hybridised}}{>C=O}$$

Q.3 (1)

Q.4 (2)



$$\underset{\text{2 propanone}}{CH_3\overset{\overset{\displaystyle O}{\|}}{C}CH_3}$$

Q.5 (4)

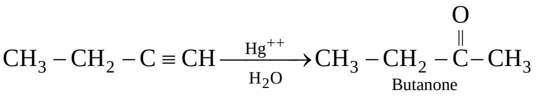
Q.6 (3)

Q.7 (2)

$$(CH_3)_2C=C(CH_3)_2 \xrightarrow{O_3} 2CH_3-CO-CH_3$$

Q.8 (1)

Q.9 (1)
It is hydration of alkynes.



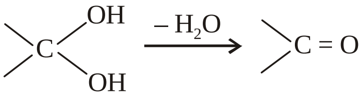
$$CH_3-CH_2-C\equiv CH \xrightarrow[H_2O]{Hg^{++}} \underset{\text{Butanone}}{CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3}$$

Q.10 (2)

Q.11 (2)

$$HC\equiv CH + H_2O \xrightarrow{HgSO_4/H_2SO_4} CH_3CHO$$

Q.12 (3)



Q.13 (1)

$$\underset{\text{Benzaldehyde}}{C_6H_5CHO} \xrightarrow[H^+/H_2O]{CH_3MgBr} \underset{2^\circ\text{Alcohol}}{C_6H_5CH(OH)CH_3}$$

Q.14 (3)

$$C_2H_5CHO + 2Cu^{+2} + 5OH^- \rightarrow \underset{\text{Red ppt}}{Cu_2O} + 3H_2O$$

$$+C_2H_5COO^-$$

$$CH_3COCH_3 + 2Cu^{+2} + 5OH^- \rightarrow \text{No reaction}$$

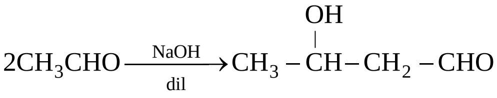
Q.15 (2)
Benzaldehyde on treatment with 50% aqueous or ethanolic alkali solution undergoes Cannizzaro's reaction like $HCHO$ (no α -hydrogen atom) *i.e.*, one molecule is oxidised and one is reduced with the formation of benzoic acid and benzyl alcohol respectively.

$$2C_6H_5CHO \xrightarrow{NaOH} C_6H_5CH_2OH + C_6H_5COONa$$

Q.16 (4)

$$2HCHO \xrightarrow[\text{Conc.}]{NaOH} CH_3OH + HCOONa$$

It is a Cannizzaro's reaction.



$$2CH_3CHO \xrightarrow[\text{dil}]{NaOH} CH_3-\overset{\overset{\displaystyle OH}{|}}{CH}-CH_2-CHO$$

It is aldol condensation reaction.

Q.17 (2)

Q.18 (1)
Silver mirror test is the test of aldehyde.

Q.19 (3)
In cannizaro's reaction the one substance is oxidized and other is reduced.

$$HCHO + HCHO \xrightarrow{KOH} CH_3OH + HCOOK$$

Q.20 (3)
Nucleophilic as addition of HCN, $NaHSO_3$ *etc*.

Q.21 (2)

$$C_6H_5CHO + (CH_3CO)_2O \xrightarrow{CH_3CO_2Na}$$

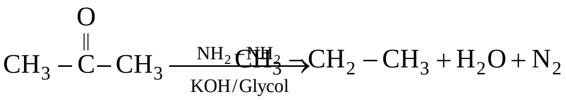
$$C_6H_5CH = CHCO_2H$$

It is Perkin's reaction.

Q.22 (1)

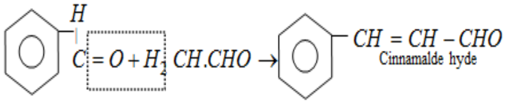
In HCHO because α-Hydrogen atom is absent.

Q.23 (4)

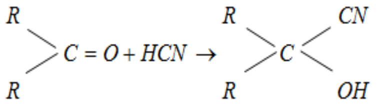


$$CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[KOH/Glycol]{NH_2-NH_2} CH_3-CH_2-CH_3 + H_2O + N_2$$

Q.24 (2)



Q.25 (3)



is an example of nucleophilic addition reaction.

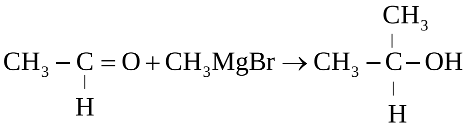
Q.26 (4)

$$2C_6H_5CHO \xrightarrow{50\%\,NaOH} C_6H_5COONa +$$

$$C_6H_5CH_2OH$$

It is Cannizzaro's reaction

Q.27 (2)



$$CH_3-\underset{\underset{H}{|}}{C}=O + CH_3MgBr \rightarrow CH_3-\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}}-OH$$

(2° alcohol)

Q.28 (2)

Q.29 (4)

Fehling solution ⇒ Alkaline $CuSO_4 + Na-K$ tartarate

Tollen's reagent ⇒ $NH_4OH + AgNO_3$

Schiff's reagent ⇒ P-rosaniline hydrochloride or magneta

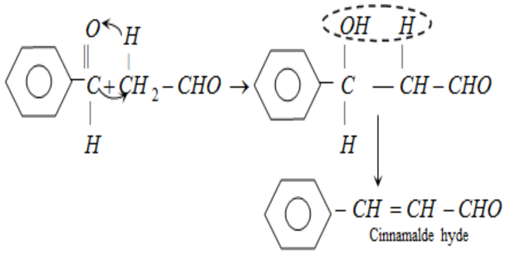
Benedict's solution ⇒ Alkaline $CuSO_4$ + Citrate ions

All these reagents are used to distinguish between aldehydes and ketones. Aldehydes reacts with all these reagents while ketones do not react.

Q.30 (1)

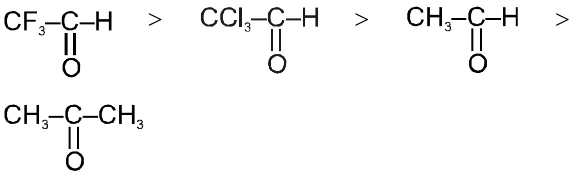
$$\underset{\text{Acetaldehyde}}{CH_3CHO} \xrightarrow[\text{Oxidation}]{KMnO_4} \underset{\text{Acetic acid}}{CH_3COOH}$$

Q.31 (4)



JEE-MAIN
OBJECTIVE QUESTIONS

Q.1 (2)

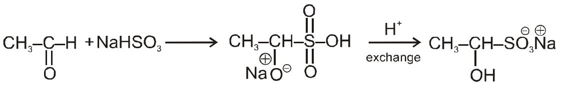


$$CF_3-\underset{\underset{O}{\|}}{C}-H > CCl_3-\underset{\underset{O}{\|}}{C}-H > CH_3-\underset{\underset{O}{\|}}{C}-H > CH_3-\underset{\underset{O}{\|}}{C}-CH_3$$

Q.2 (3)

–I and –M group increase electrophilicity on –CHO group so rate of addition reaction increase and also increases equilibrium constant.

Q.3 (4)



$$CH_3-\underset{\underset{O}{\|}}{C}-H + NaHSO_3 \longrightarrow CH_3-\underset{\underset{\overset{\oplus}{Na}\overset{\ominus}{O}}{|}}{CH}-\underset{\underset{O}{\|}}{\overset{\overset{O}{\|}}{S}}-OH \xrightarrow[\text{exchange}]{H^+} CH_3-\underset{\underset{OH}{|}}{CH}-\overset{\ominus}{S}O_3\overset{\oplus}{Na}$$

Q.4 (2)

It is protection of carbonyl compound.

Q.5 (2)

As the positive charge decreases and steric hinderance increases on carbonyl group the rate of nucleophilic addition reaction decreases.

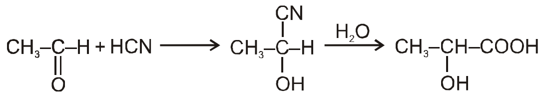
Q.6 (2)

As the positive charge decreases and steric hinderance increases on carbonyl group the rate of nucleophilic addition reaction decreases.

Q.7 (1)

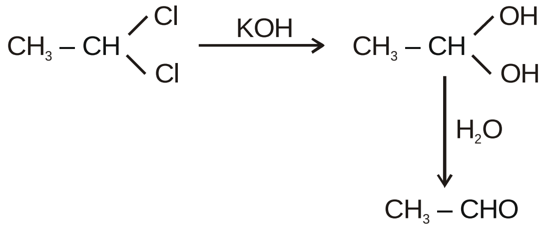
–I and –M group increase electrophilicity on –CHO group so rate of nuclephilic addition reaction increases.

Q.8 **B**

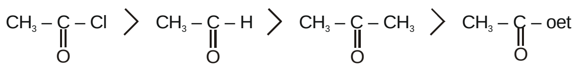


$CH_3-\underset{\underset{O}{\|}}{C}-H + HCN \longrightarrow CH_3-\overset{CN}{\underset{OH}{C}}-H \xrightarrow{H_2O} CH_3-\underset{OH}{CH}-COOH$

Q.9 **C**



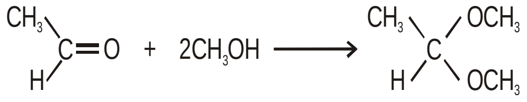
Q.10 (1)



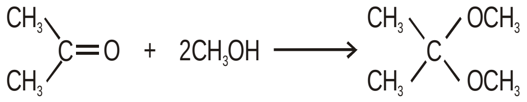
$CH_3-\underset{\underset{O}{\|}}{C}-Cl > CH_3-\underset{\underset{O}{\|}}{C}-H > CH_3-\underset{\underset{O}{\|}}{C}-CH_3 > CH_3-\underset{\underset{O}{\|}}{C}-oet$

Decreasing Order of reactivity towards N.A.R.

Q.11 (4)

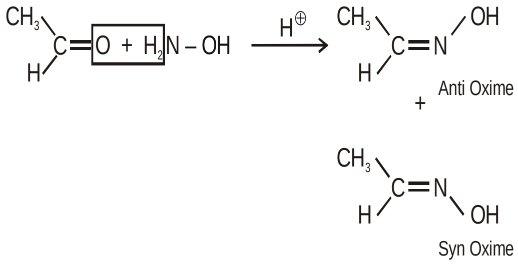


Acetal

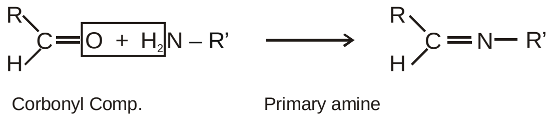


Ketal

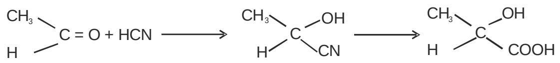
Q.12 (1)



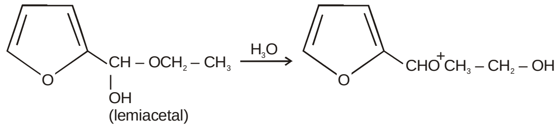
Q.13 (1)



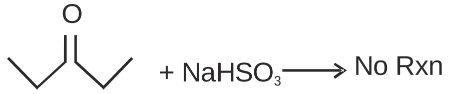
Q.14 **(3)**



Q.15 **D**



Q.16 (4)

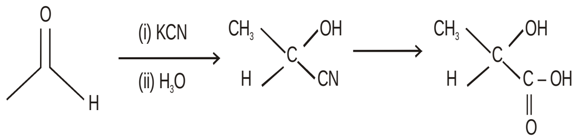


(due to streric hindrence)

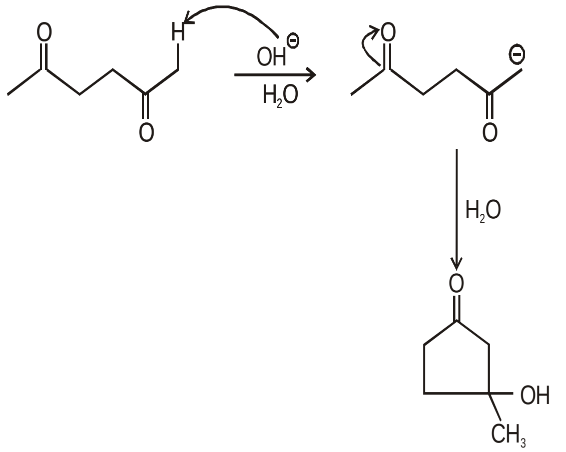
Q.17 (2)

$Ph-CH=\boxed{O+H_2}N-NH_2 \xrightarrow[-H_2O]{H} PhCH=N-NH_2$ Hydrazone

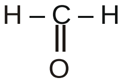
Q.18 (2)



Q.19 (2)

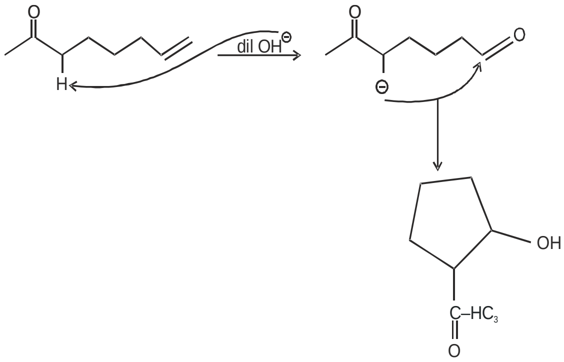


Q.20 (4)

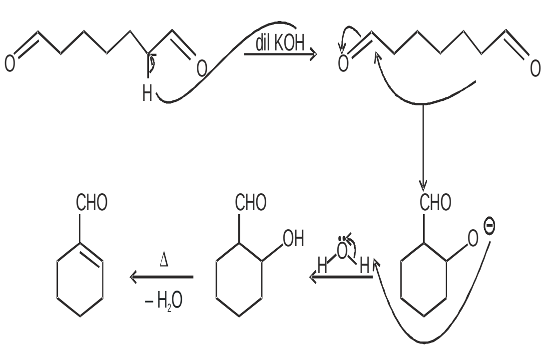


$H-\underset{\underset{O}{\|}}{C}-H$ have no α – H so do not show aldol Rx^n

Q.21 (2)



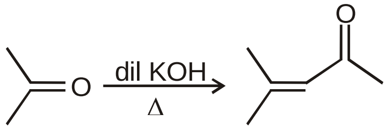
Q.22 (4)



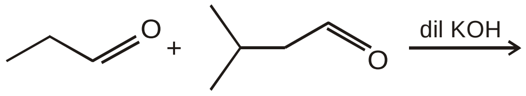
Q.23 (4)

Aldol addition are proceed in presence of Base catlyst as well as acid catalyst.

Q.24 (2)

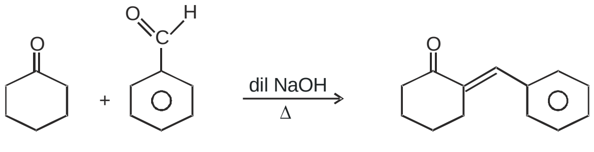


Q.25 (3)



borh aldehyde having α – H So 4 product will be formed in which two self and two cross. Product will be obtained.

Q.26 (4)

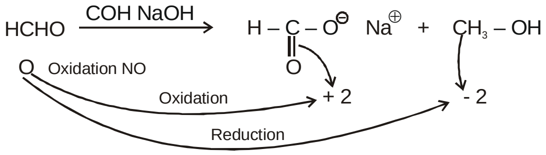


(x) (y)

Q.27 (4)

α-hydrogen absent.

Q.28 (3)



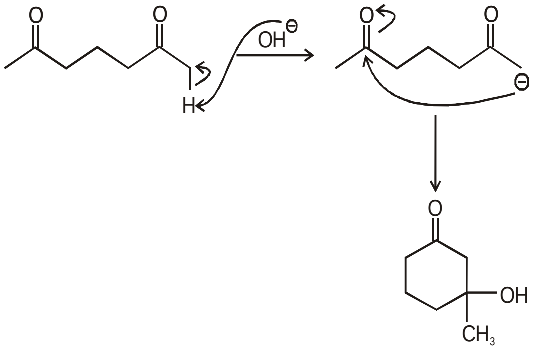
Q.29 (2)

Corbonyl Comp having no α – H gives cannizaro Rxⁿ

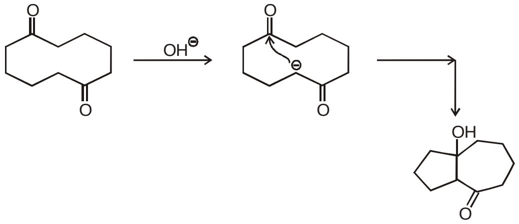
Q.30 (4)

Intramolecular aldol reaction -

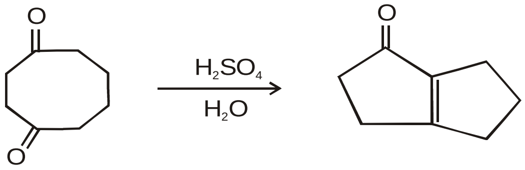
(i)



(ii)

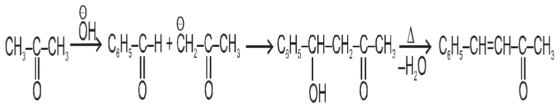


Q.31 (1)



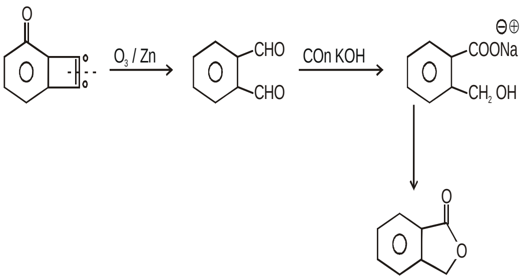
(Intramolecular aldol Reaction)

Q.32 (1)

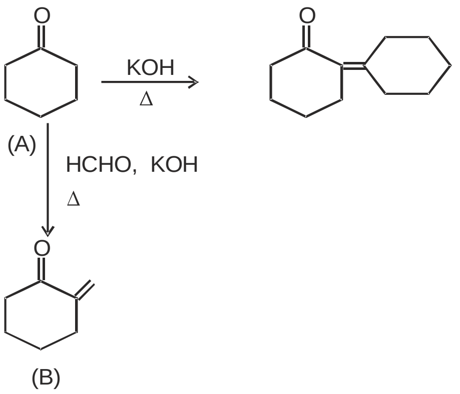


$$CH_3-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow{\overset{\ominus}{OH}} C_6H_5-\underset{\underset{O}{\|}}{C}-H + \overset{\ominus}{C}H_2-\underset{\underset{O}{\|}}{C}-CH_3 \longrightarrow C_6H_5-\underset{\underset{OH}{|}}{CH}-CH_2-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow[-H_2O]{\Delta} C_6H_5-CH=CH-\underset{\underset{O}{\|}}{C}-CH_3$$

Q.33 (1)



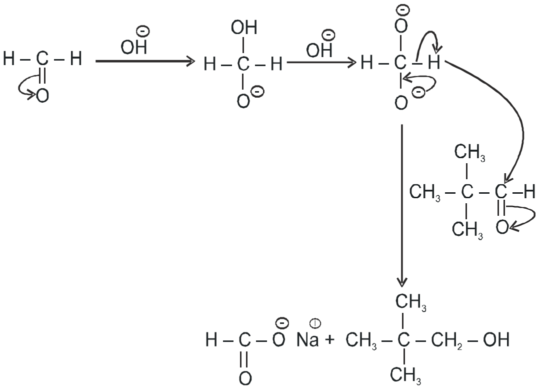
Q.34 (2)



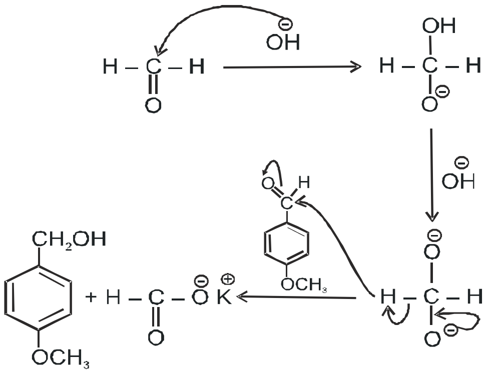
Q.35 (1,2,4)
Compound which have α-hydrogen gives aldol condensation reaction.

Q.36 **(4)**
$CH_3 – CHO$ (α – Hydrogen is present).

Q.37 (1)

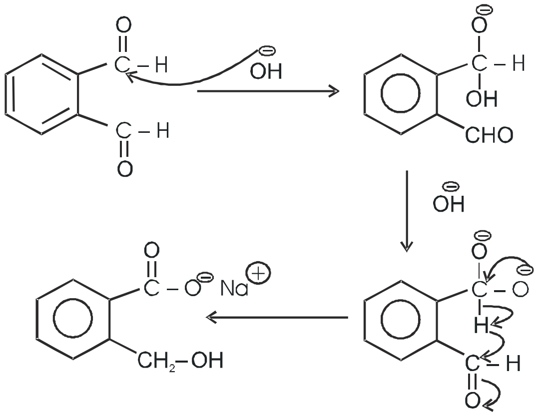


Q.38 (1)

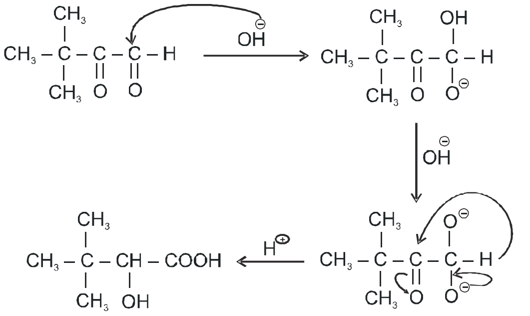


Q.39 **(3)**
Dioxide anion is a better hydride donor, and presence of $–OCH_3$ group further increases the electron density.

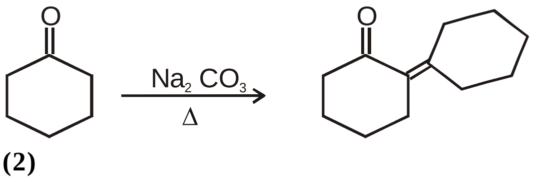
Q.40 **(3)**



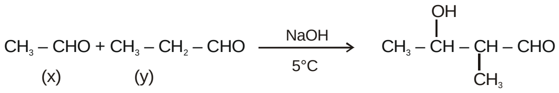
Q.41 (2)



Q.42 (1)

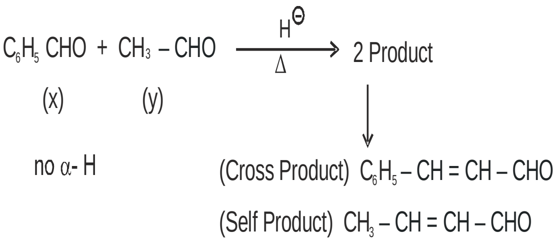


Q.43 **(2)**

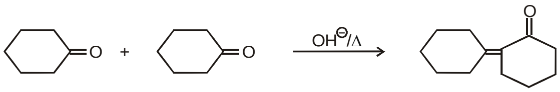


$$\underset{(x)}{CH_3-CHO} + \underset{(y)}{CH_3-CH_2-CHO} \xrightarrow[5^\circ C]{NaOH} CH_3-\overset{\overset{OH}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CHO$$

Q.44 **(3)**

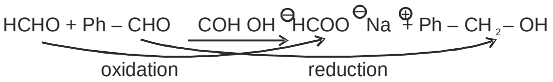


Q.45 **(4)**



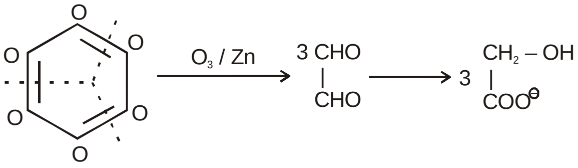
Q.46 **(1)**

Cross Cannizzar Reaction



This is Redox Reduction.

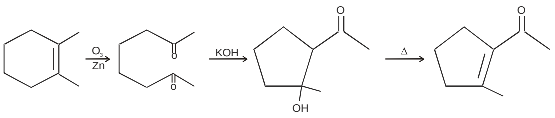
Q.47 (3)



Q.48 (4)

compound in which $[CH_3-\underset{\underset{O}{||}}{C}-]$ group is present will react with NaoI (NaOH + I_2)

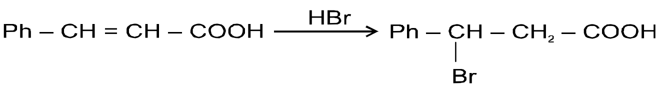
Q.49 (2)



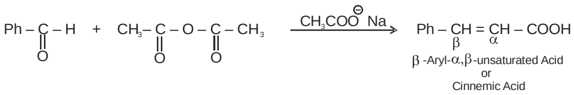
Q.50 (3)

Q.51 (2)

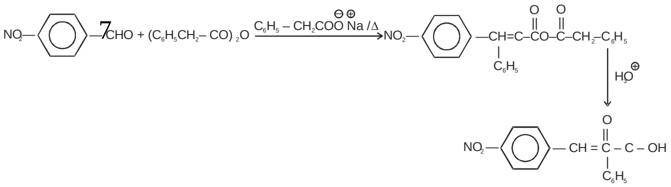
Perkin reaction



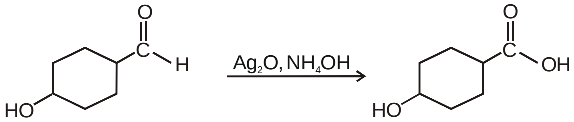
Q.52 (3)



Q.53 (4)



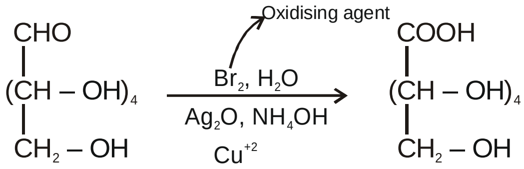
Q.54(3)



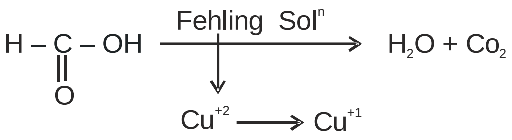
Q.55 (1)

P.C.C. → Pyridine Chloro Cromate

Q.56 (4)



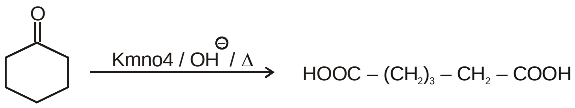
Q.57 (4)



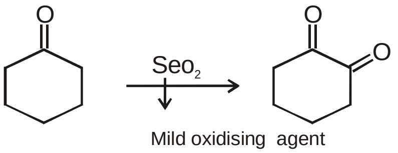
Q.58 (2)

Schiff's reagent is [P rosanilline + HCl + SO_2] which is used for different b/w Aldehyde or Ketone.

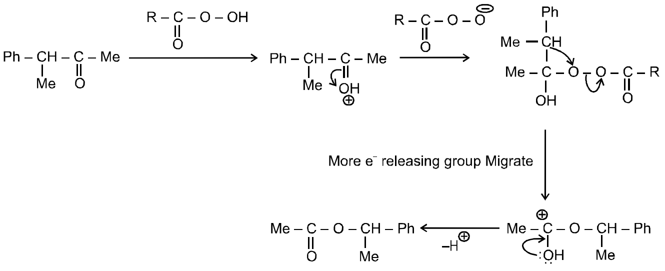
Q.59 (1)



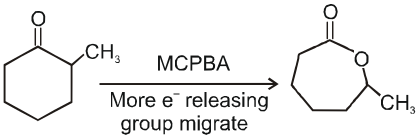
Q.60 (2)



Q.61 (1)



Q.62 (3)



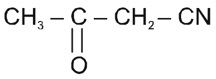
Q.63 (4)

$$CH_6H_5 - CHO \xrightarrow{[Ag\,(NH_3)_2]^{\oplus}OH^{\ominus}} C_6H_5 - COOH + Ag$$

$$CH_3 - CHO \xrightarrow{H} Ch_3CH_3COOH + AgI$$

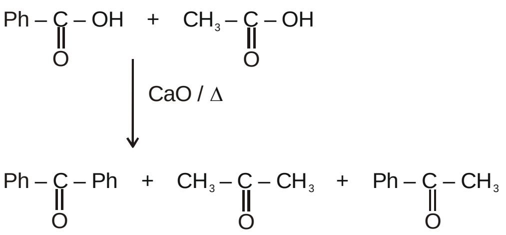
$$H\,COOH \xrightarrow{H} H_2O + CO_2 + AgI$$

Q.64 (4)



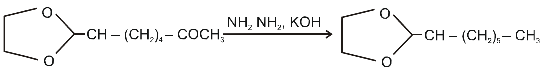
$$CH_3 - \underset{\underset{O}{||}}{C} - CH_2 - CN$$

Q.65 (4)



$$Ph - \underset{\underset{O}{||}}{C} - OH + CH_3 - \underset{\underset{O}{||}}{C} - OH \xrightarrow{CaO\,/\,\Delta} Ph - \underset{\underset{O}{||}}{C} - Ph + CH_3 - \underset{\underset{O}{||}}{C} - CH_3 + Ph - \underset{\underset{O}{||}}{C} - CH_3$$

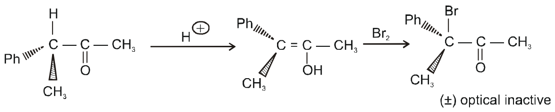
Q.66 (1)



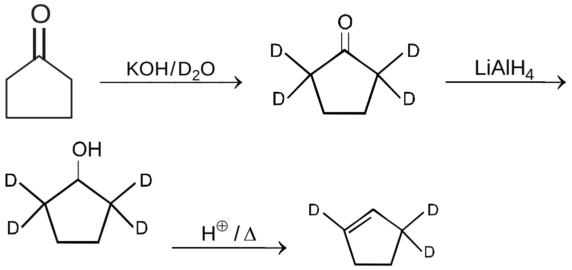
Acetal is hydrolysed in acidic Medium so clemmensen reduction is not used.

Q.67 (2)
for base sensitive group clemmesen reduction is used.

Q.68 (1)

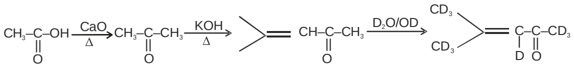


Q.69 (3)



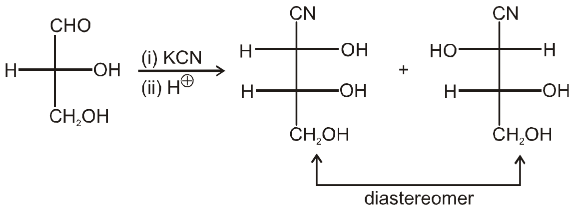
Q.70 (2)
$CH_3 - CHO$ ⟶ negative Lucas test

Q.71 (2)

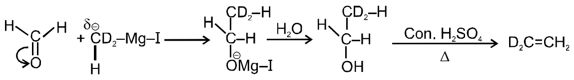


JEE-ADVANCED OBJECTIVE QUESTIONS

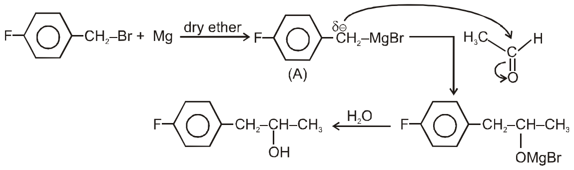
Q.1 A



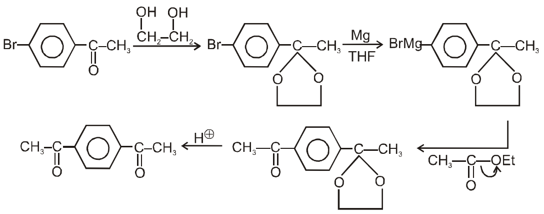
Q.2 C



Q.3 B

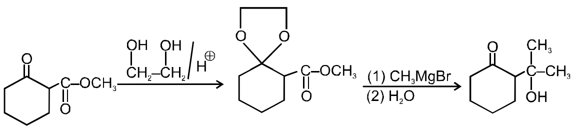


Q.4 **C**

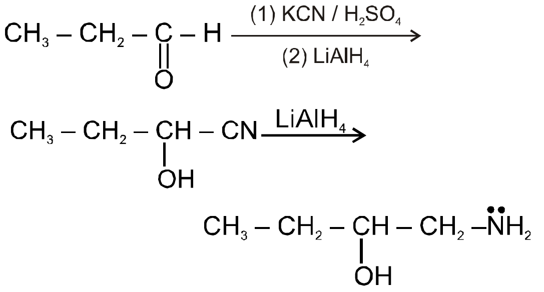


Grignard reagent is stable in THF. Grignard reagent reacts with epoxide hence (B) can't be the answer.

Q.5 **B**



Q.6 **A**



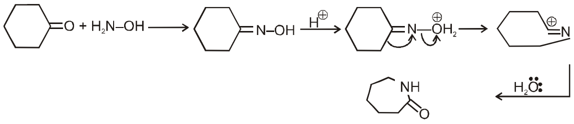
$$CH_3-CH_2-\underset{\underset{O}{\|}}{C}-H \xrightarrow[(2)\ LiAlH_4]{(1)\ KCN/H_2SO_4}$$

$$CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CN \xrightarrow{LiAlH_4}$$

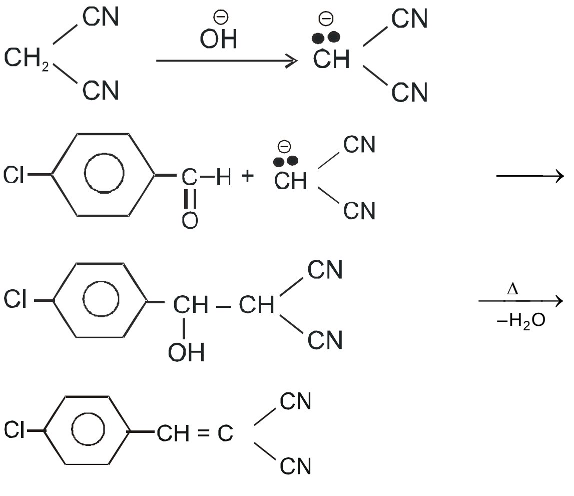
$$CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_2-\ddot{N}H_2$$

Q.7 **D**

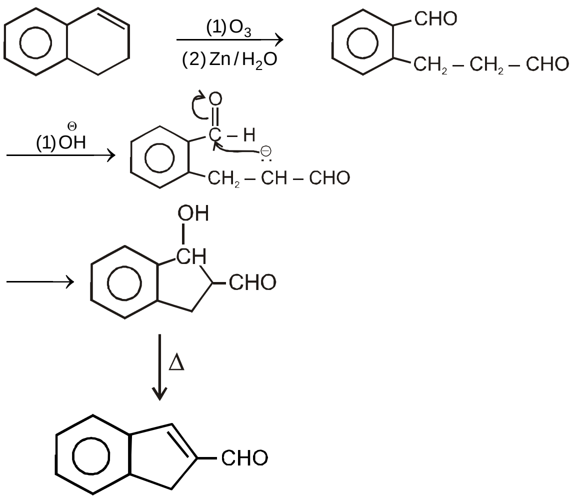
Beckmanns rearrangement



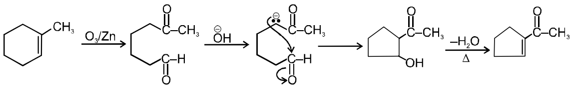
Q.8 **A**



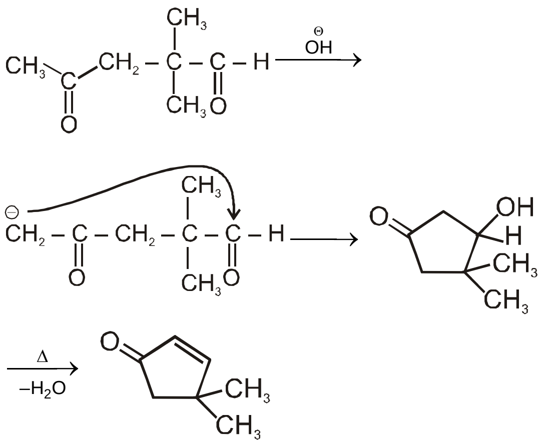
Q.9 **B**



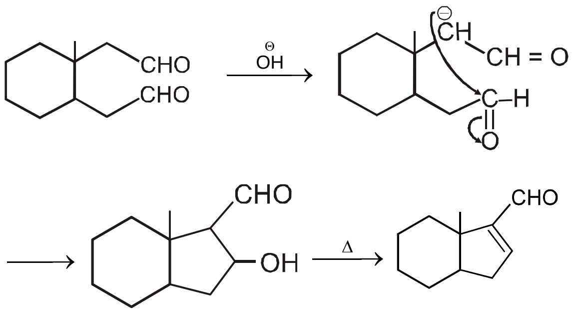
Q.10 **B**



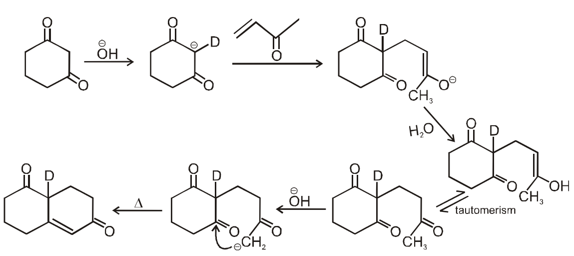
Q.11 **C**



Q.12 **A**



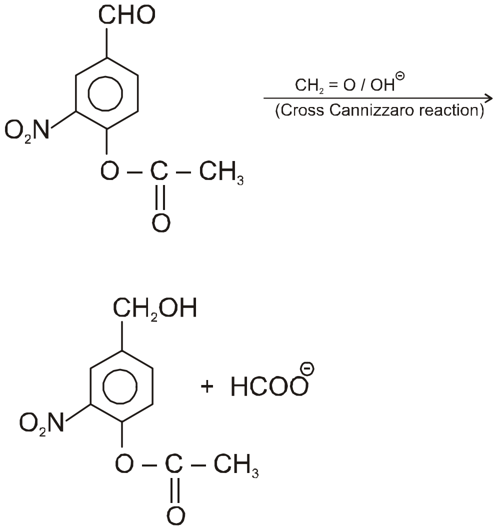
Q.13 **C**



Q.14 **B**

Aldol condensation reaction.

Q.15 **D**



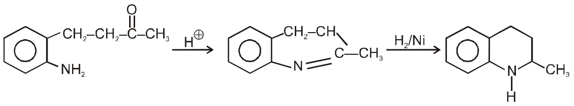
Q.16 **C**

It is an intramolecular cannizzaro reaction.

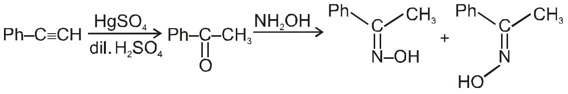
Q.17 **A**

Knoevenagal reaction

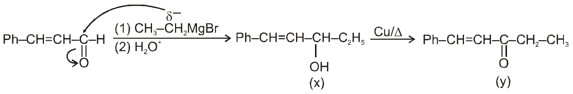
Q.18 **B**



Q.19 **D**

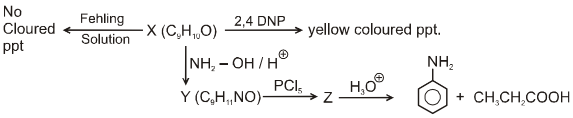


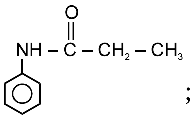
Q.20 **B**



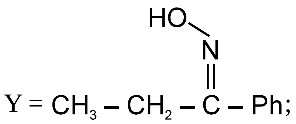
Q.21 **(C)**

Q.22 **B**

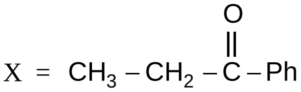


Z =  ;

$NH–\overset{O}{\overset{\|}{C}}–CH_2–CH_3$

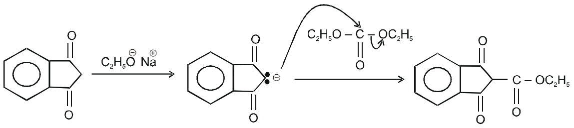


$$Y = CH_3 – CH_2 – \overset{\overset{HO\diagdown}{N}}{\overset{\|}{C}} – Ph;$$



$$X = CH_3 – CH_2 – \overset{O}{\overset{\|}{C}} – Ph$$

Q.23 **C**



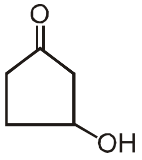
Q.24 (C)

In (C) option the given reaction will not yield benzaldehyde.

Q.25 (C)

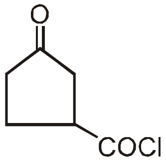
esters are not reduced by $NaBH_4$, >C=O (carbonyl) change to – CH(OH)- by use of $NaBH_4$

Q.26 (B)



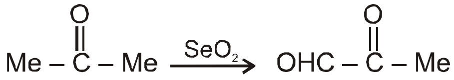
due to presence of –OH group

Q.27 (A)



due to presence of –COCl group

Q.28 (D)

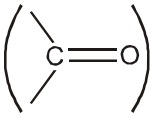


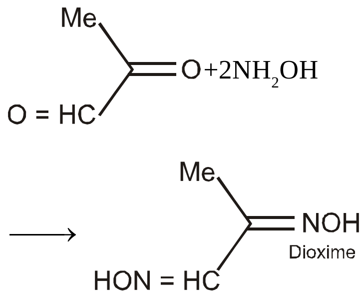
$$Me – \overset{O}{\overset{\|}{C}} – Me \xrightarrow{SeO_2} OHC – \overset{O}{\overset{\|}{C}} – Me$$

In (a), (P) reduces Tollens reagent, since it contains (–CHO) group.

In (b), (P) gives iodoform test, since it contains (MeCO–) group.

In (c), (P) forms dioxime, since it contains (–CHO)

and  groups.



In (d), (P) does not gives cerric ammonium nitrate test, since this test is given by alcohols and (P) does not contain an alcoholic group. So the answer is (D).

Q.29 (C)

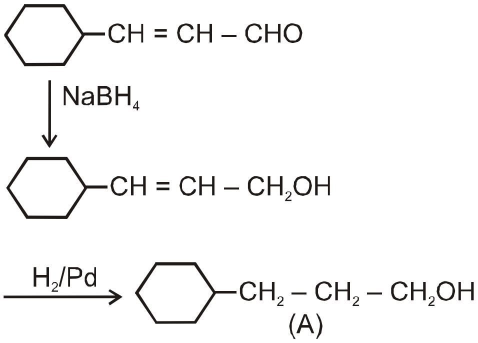
Q.30 (C)

Acetaldehyde reacts with Tollens, Schiff’s , and Fehling’s solution but acetone does not. But with H_2 / Ni both reacts.

Q.31 (B)

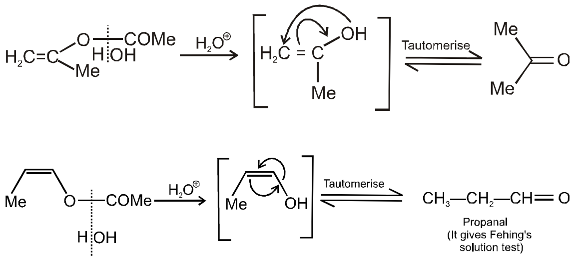
Q.32 (A)

Q.33 (B)



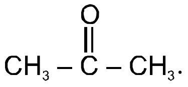
(B)

Q.34 (C)



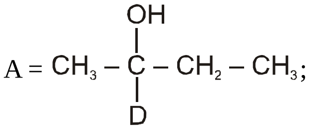
Q.35 (C)

Only C on hydrolysis gives $CH_3 – OH$ and

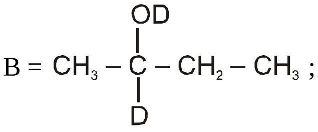


$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$.

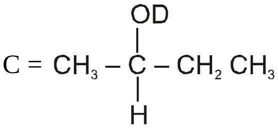
Q.36 (B)



$A = CH_3 - \underset{D}{\overset{OH}{C}} - CH_2 - CH_3;$

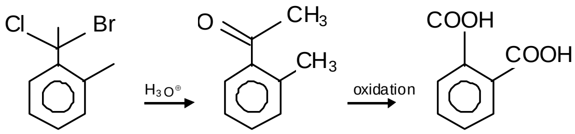


$B = CH_3 - \underset{D}{\overset{OD}{C}} - CH_2 - CH_3\ ;$

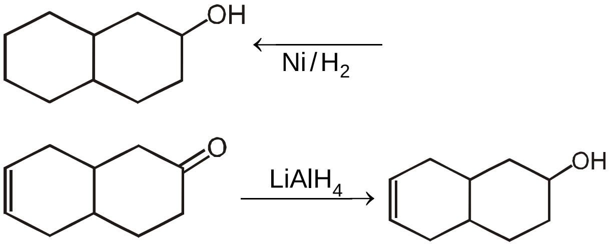


$C = CH_3 - \underset{H}{\overset{OD}{C}} - CH_2\ CH_3$

Q.37 (B)



Q.38 (D)



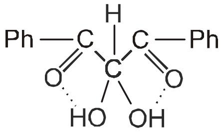
JEE-ADVANCED

MCQ/COMPREHENSION/COLUMN MATCHING

Q.1 **(AC)**

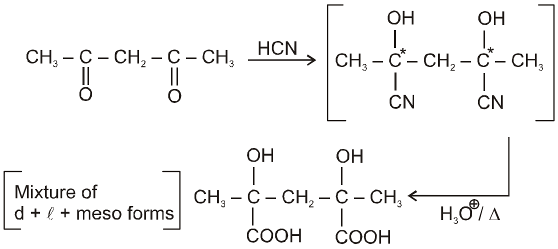
(A) Due to substrate (steric factor)

(B) H bonding in



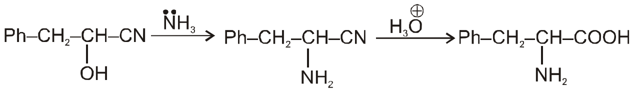
(C) Cyanohydrin formation is usually reversible

Q.2 **(BCD)**

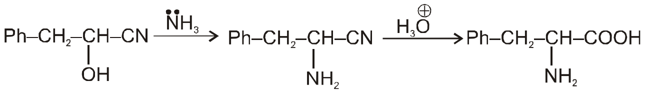


Q.3 **(ABC)**

(a) Ph–CH_2–CH=O $\xrightarrow{KCN/H_2O}$

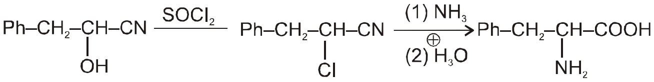


(b) $Ph–CH_2–CH=O \xrightarrow{KCN/NH_4Cl}$



$$\underset{OH}{Ph–CH_2–CH–CN} \xrightarrow{\ddot{N}H_3} \underset{NH_2}{Ph–CH_2–CH–CN} \xrightarrow{H_3\overset{\oplus}{O}} \underset{NH_2}{Ph–CH_2–CH–COOH}$$

(c) $Ph–CH_2–CH=O \xrightarrow{HCN/NaOH}$



$$\underset{OH}{Ph–CH_2–CH–CN} \xrightarrow{SOCl_2} \underset{Cl}{Ph–CH_2–CH–CN} \xrightarrow[(2)\ H_3\overset{\oplus}{O}]{(1)\ NH_3} \underset{NH_2}{Ph–CH_2–CH–COOH}$$

Q.4 **(ABCD)**
Beckmanns rearrangement

Q.5 **(AB)**
Aldehyde and ketone give positive Test with 2, 4 Dinitrophenyl hydrozine.

Q.6 **(ABC)**
Haloform reaction

Q.7 **(ABC)**
Iodoform test.

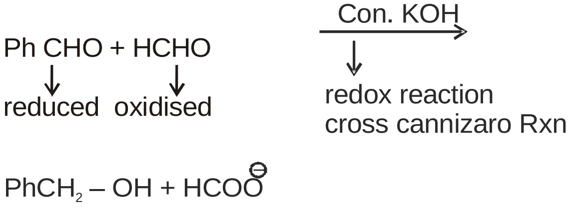
Q.8 **(AD)**

$$Ph – CHO + HCHO \xrightarrow{CON.\ NaOH}$$

$$CH_3 – CH_2– OH + COO^{\ominus}$$

oxidation of HCHO and reduction of PhCHO

Q.9 **(ABCD)**



Ph CHO + HCHO $\xrightarrow{Con.\ KOH}$

reduced oxidised

redox reaction
cross cannizaro Rxn

$$PhCH_2 – OH + HCOO^{\ominus}$$

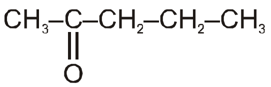
Q.10 **(ABD)**
(A) Perkin reaction
(B) Knoevenagel reaction
(D) Reformatsky reaction

Q.11 **(BD)**
Aliphatic Aldehyde and a-hydroxy ketone give red ppt with Fehling solution.

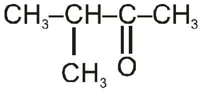
Q.12 **(ABCD)**
Aliphetic and Aromatic Aldihyde give silver mirror with Tollen regent

Q.13 **(ABC)**
Aldehyde, hemiacetal gives positive poller test

Q.14 **(AD)**

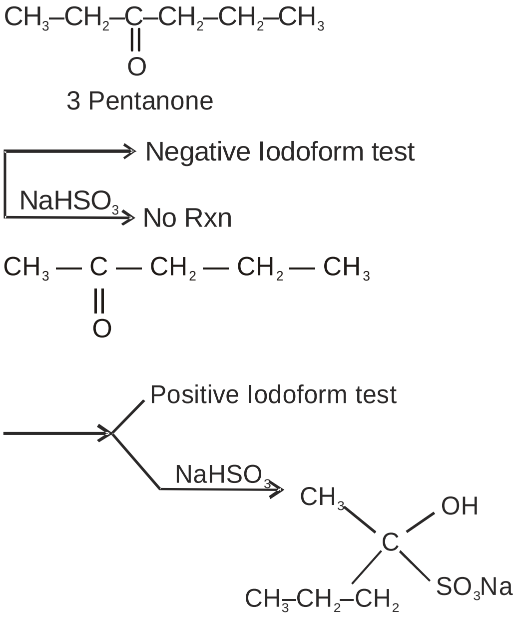


$$CH_3–\underset{\overset{||}{O}}{C}–CH_2–CH_2–CH_3$$ and



$$CH_3–\underset{CH_3}{CH}–\underset{\overset{||}{O}}{C}–CH_3$$ gives positive Iodoform test

Q.15 **(AB)**



$$CH_3–CH_2–\underset{\overset{||}{O}}{C}–CH_2–CH_2–CH_3$$

3 Pentanone

$\rightarrow$ Negative Iodoform test

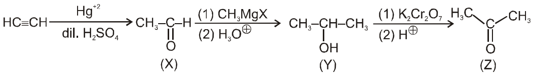
$\xrightarrow{NaHSO_3}$ No Rxn

$$CH_3 — \underset{\overset{||}{O}}{C} — CH_2 — CH_2 — CH_3$$

$\rightarrow$ Positive Iodoform test

$\xrightarrow{NaHSO_3}$ $CH_3–CH_2–CH_2–C(CH_3)(OH)(SO_3Na)$

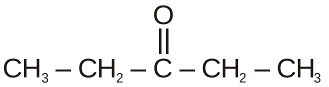
Q.16 **(ABC)**



$$HC{\equiv}CH \xrightarrow[dil.\ H_2SO_4]{Hg^{+2}} \underset{(X)}{CH_3–\underset{\overset{||}{O}}{C}–H} \xrightarrow[(2)\ H_3O^{\oplus}]{(1)\ CH_3MgX} \underset{(Y)}{CH_3–\underset{OH}{CH}–CH_3} \xrightarrow[(2)\ H^{\oplus}]{(1)\ K_2Cr_2O_7} \underset{(Z)}{H_3C–\underset{\overset{||}{O}}{C}–CH_3}$$

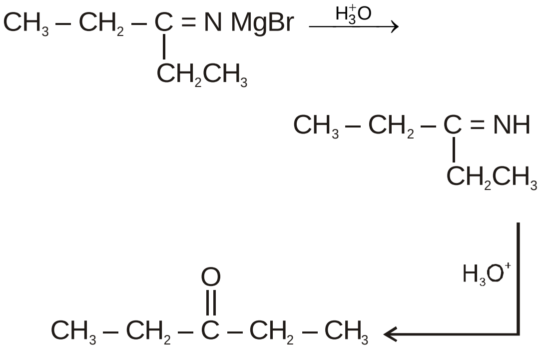
Q.17 **(ABD)**

(A) $(CH_3CH_2COO)_2Ca \xrightarrow{\Delta}$



$$CH_3 – CH_2 – \overset{\overset{O}{||}}{C} – CH_2 – CH_3$$

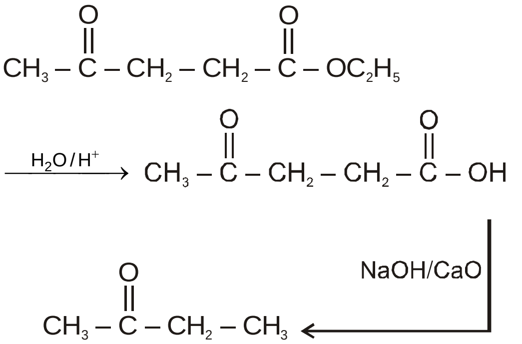
(B) $CH_3–CH_2–C \equiv N \xrightarrow{CH_3–CH_2–MgBr}$



$$CH_3 – CH_2 – \underset{CH_2CH_3}{C} = N\ MgBr \xrightarrow{H_3^{+}O} CH_3 – CH_2 – \underset{CH_2CH_3}{C} = NH$$

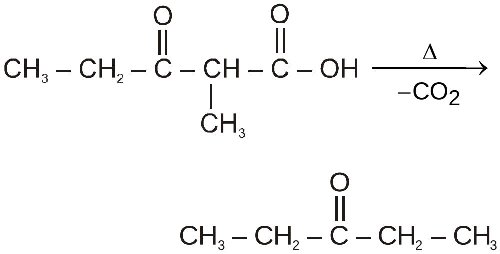
$$\xrightarrow{H_3O^+} CH_3 – CH_2 – \overset{\overset{O}{||}}{C} – CH_2 – CH_3$$

(C)



$$CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-OC_2H_5 \xrightarrow{H_2O/H^+} CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-OH \xrightarrow{NaOH/CaO} CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$$

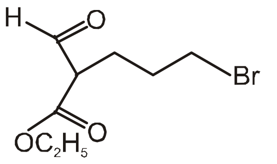
(D)



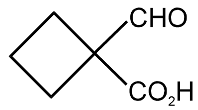
$$CH_3-CH_2-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-OH \xrightarrow[-CO_2]{\Delta} CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$$

Q.18 **(BD)**

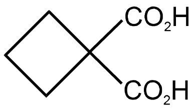
(W) =



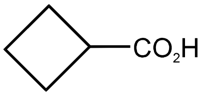
(X) =



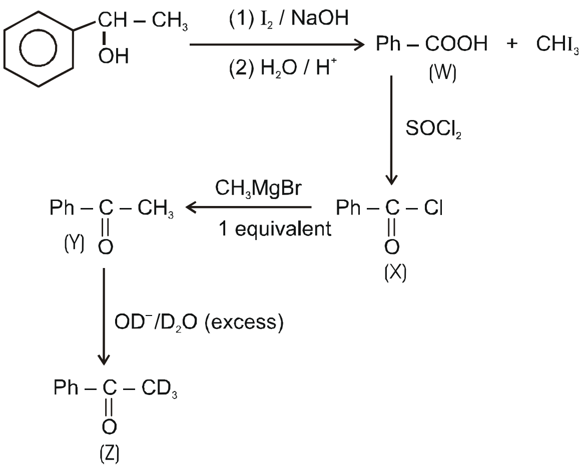
(Y) =



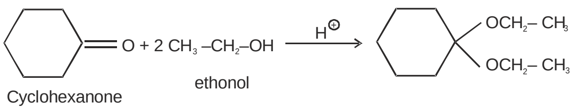
(Z) =



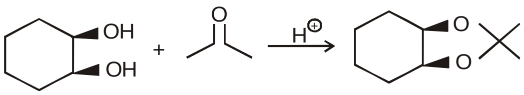
Q.19 **(ABC)**



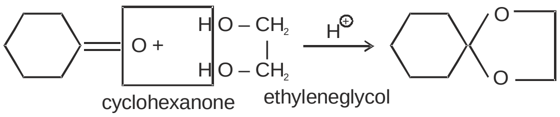
Q.20 (B)



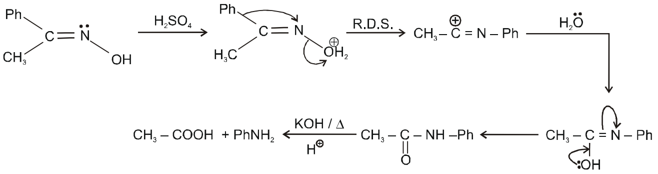
Q.21 (B)



Q.22 (B)

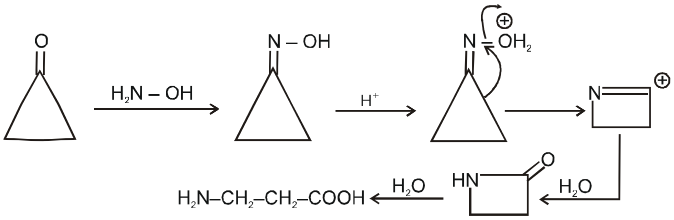


Q.23 (A)

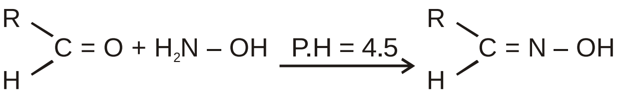


Q.24 (B)
Migration of phenyl group is rds. (Step II)

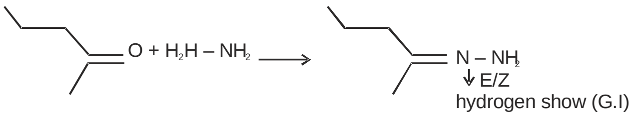
Q.25 (A)



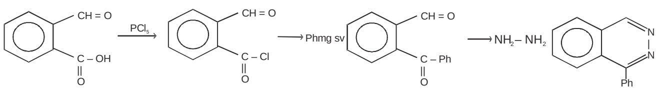
Q.26 (A)



Q.27 ((D)



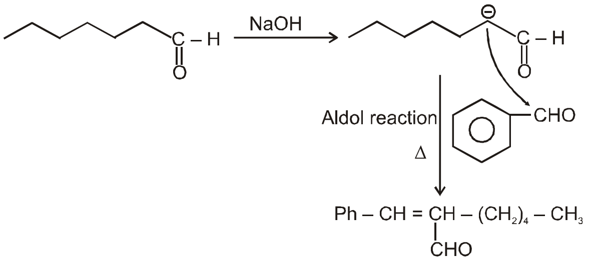
Q.28 (C)



Q.29 (D)

α – H hydrogen is present.

Q.30 (D)



Q.31 (D)

Polycarbonyl compound with α hydrogen gives intramolecular aldol condensation reaction in presence of alkaline medium.

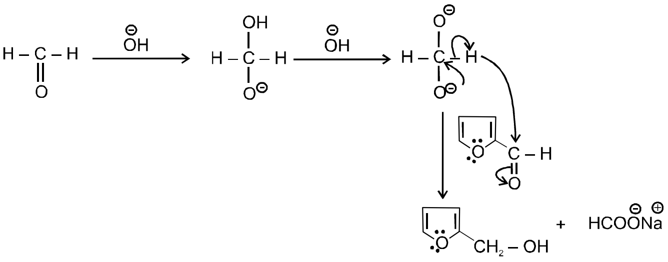
Q.32 (B)

Transfer of H^- ion is rds.

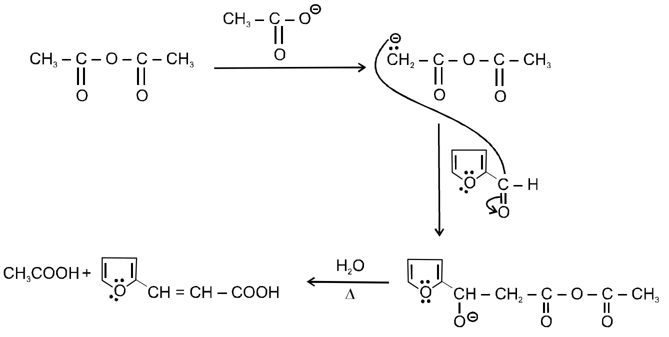
Q.33 (D) All of these

Such aldehyde will from enolate ion, conjugate base of hydrate of aldehyde and also undergo polymerisation.

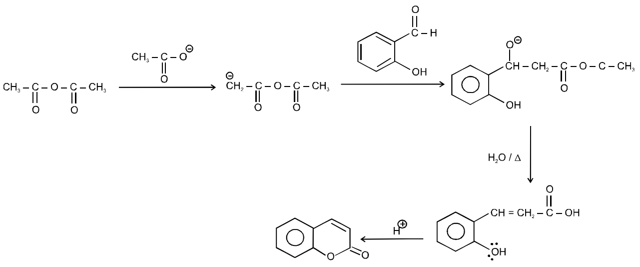
Q.34 (C)



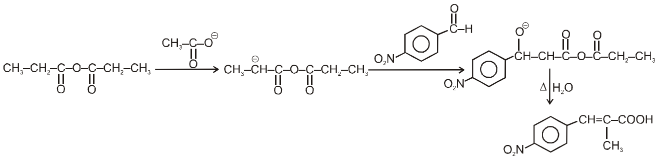
Q.35 (A)



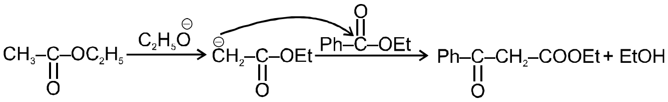
Q.36 (A)



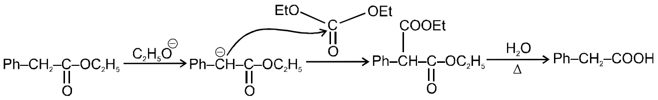
Q.37 (A)



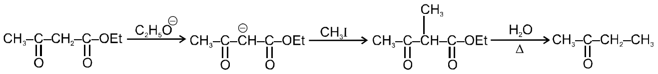
Q.38 (A)



Q.39 (D)



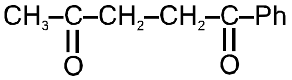
Q.40 (A)



Q.41 (A)

Step 'a' is rds.

Q.42 (C)



$CH_3-\underset{\underset{O}{\|}}{C}-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-Ph$ give halloform reaction.

Q.43 (B)

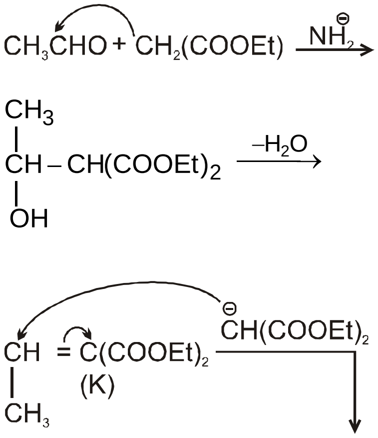
Step 'c' produce most acidic hydrogen due to two halogen atom.

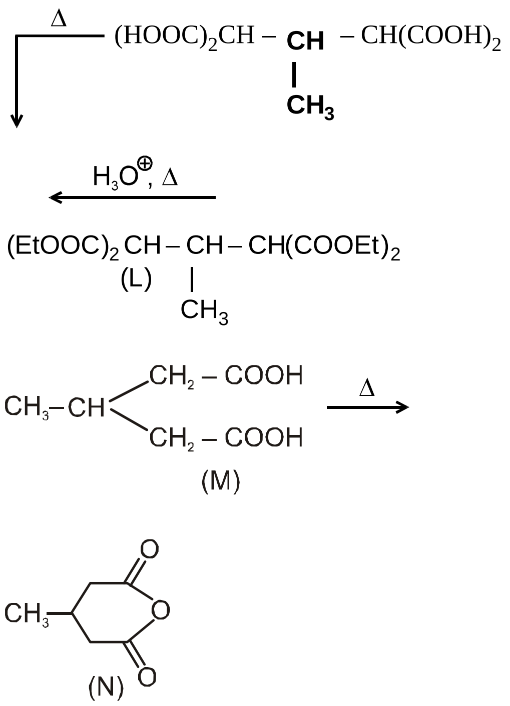
Q.44 (C)

Q.45 (C)

Q.46 (D)

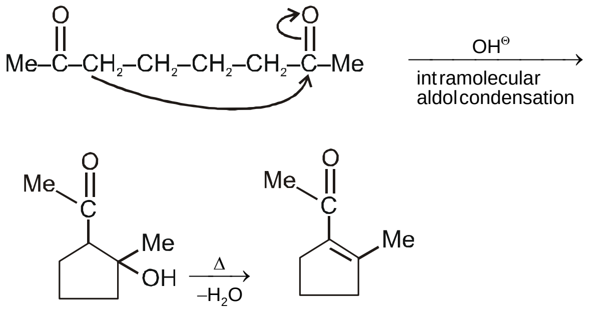
(44 to 46)



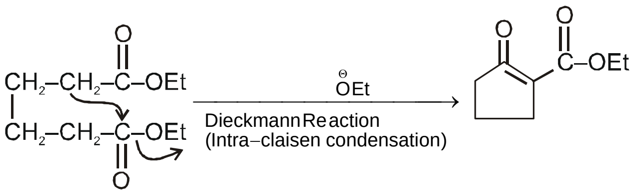


Q.47 (A) - q ; (B) - p ; (C) - s ; (D) - r

(A)



(B)



(C) Perkin's condensation reaction.

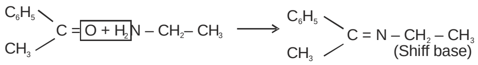
(D) Benzil-Benzilic acid rearrangement.

Q.48 **(A → R, B → Q, C → Q, D → P)**

(A) $CH_2=CH-CHO \xrightarrow{NaBH_4} CH_2=CH-CH_2-OH$ (Allyl alcohal)

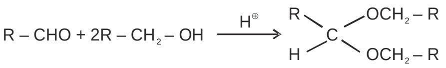
(B) $C_6H_5-CHO + H_2N-Ph \xrightarrow[-HO]{H^\oplus} C_6H_5-CH=N-Ph$ (Shiff base)

(C)



$\begin{matrix}C_6H_5\\CH_3\end{matrix} > C = \boxed{O + H_2}N-CH_2-CH_3 \longrightarrow \begin{matrix}C_6H_5\\CH_3\end{matrix} > C=N-CH_2-CH_3$ (Shiff base)

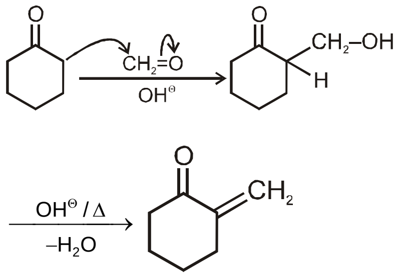
(d)



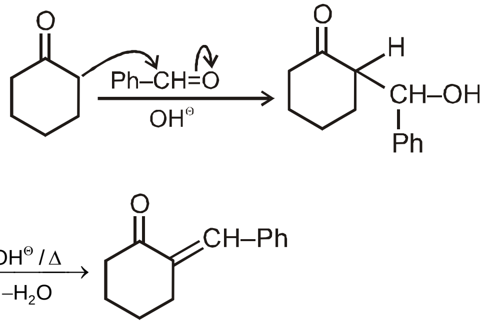
$R-CHO + 2R-CH_2-OH \xrightarrow{H^\oplus} \begin{matrix}R\\H\end{matrix} > C < \begin{matrix}OCH_2-R\\OCH_2-R\end{matrix}$

Q.49 (A) - p,q ; (B) - p,r ; (C) - q,s ; (D) - r,s

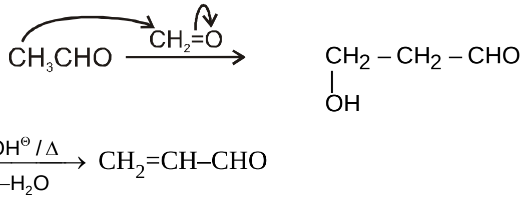
(A)



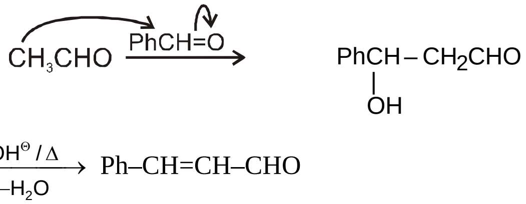
(B)



(C)



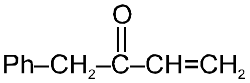
(D)



Q.50 **A → P,S ; B → Q, S ; C → Q, S ; D → R , S**

Q.51 (A) - p, q, s ; (B) - p, q, r, s ; (C) - p ; (D) - q, r, s

(A)



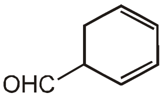
$Ph-CH_2-\overset{O}{\overset{\|}{C}}-CH=CH_2$

- 1, 4-addition.

- Shows tautomerism as it has two α-H.

- Gives +ve 2, 4-DNP test as the carbonyl group is present.

(B)

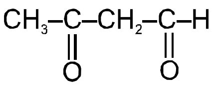


- Gives 1, 4-addition.

- Shows tautomerism as it has two α-H.

- Gives +ve tollen's test as it has aldehyde groups.
  - +ve 2, 4-dNP test.

(C) $CH_3–CH=CH–CH = CH_2$
- It is a conjugated diene and gives 1, 4-addition.

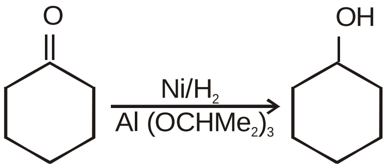
(D) 
$CH_3–\overset{\overset{O}{||}}{C}–CH_2–\overset{\overset{O}{||}}{C}–H$

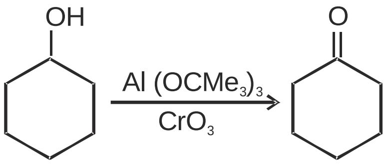
- Shows tautomerism as it has active methylene group (α-H).

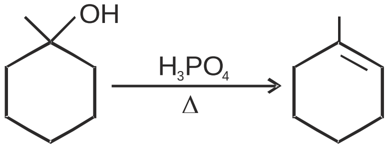
- +ve tollen's test since –CHO group is present.

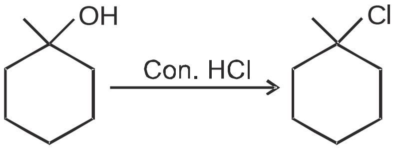
- +ve 2, 4-DNP test.

Q.52 A → P ; B → Q ; C → R ; D → S

(A) 

(B) 

(C) 

(D) 

Q.53 (1)-ii, (2)-iii, (3)-iv, (4)-i
Factual

Q.54 (1)-i, (2)-iii, (3)-ii, (4)-iv
Factual

NUMERICAL VALUE BASED

Q.1 [2]

Q.2 [3]
HCOOH, CHOCOOH, CHOCHO

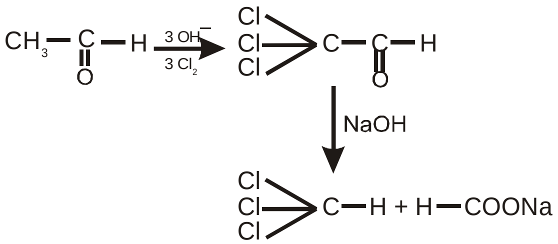
Q.3 [4]

Q.4 [1]

Q.5 [2]

Q.6 [3]

Q.7 [4]

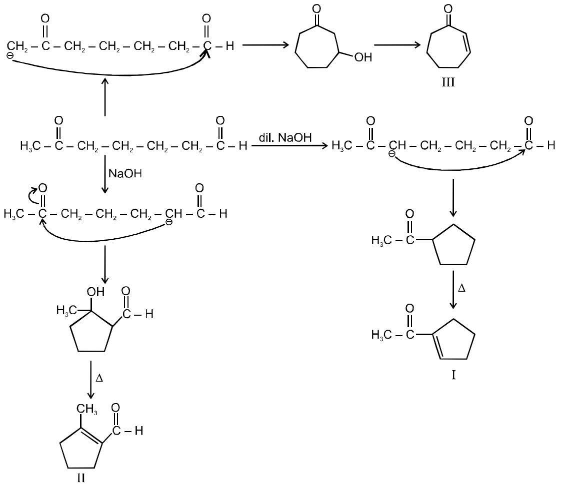


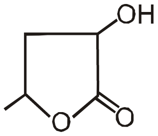
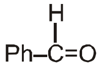
(Chloroform)

Q.8 [3]
3 molecules condense

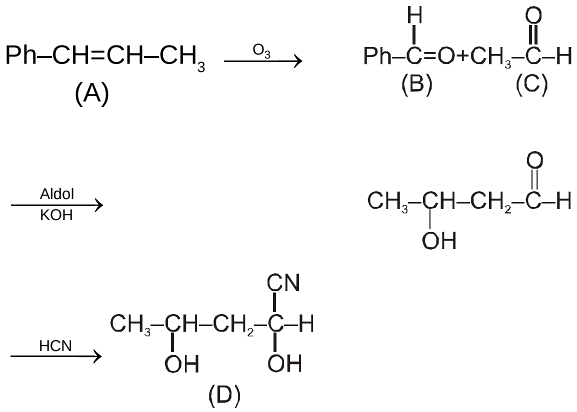
Q.9 [0]
In decacarbonyl di manganese (O). no carbonyl group is in bridged position.

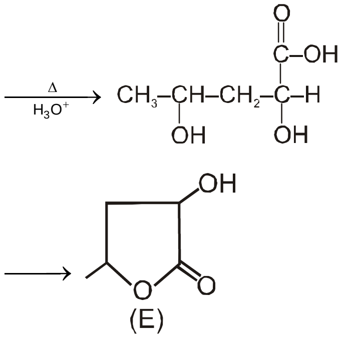
Q.10 [3]



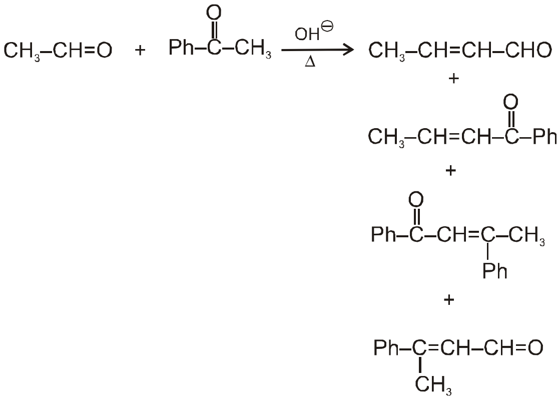
Q.11 The structure of E is  and B is 

so, (E – B) = (116 – 106) = 10



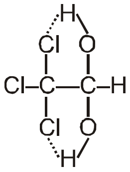


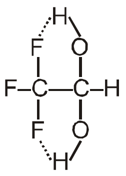
Q.12 [8]

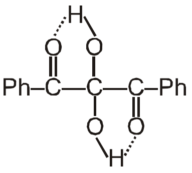


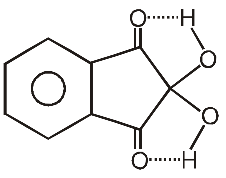
Total structure product = 4
Total products = 8
all the four product have geometrical isomers.

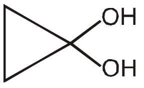
Q.13 [5] (2,3,4,5,6)

(2)


(3)


(4)


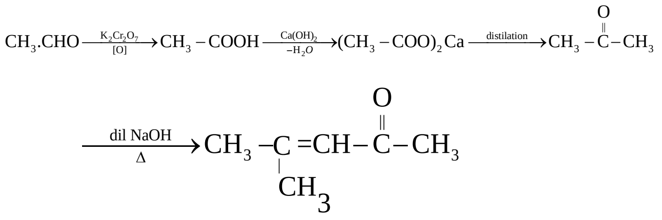
(5)


(6)


(decreases ring strain)

Q.14 [2]
HCHO and RCHO

Q.15 [6]



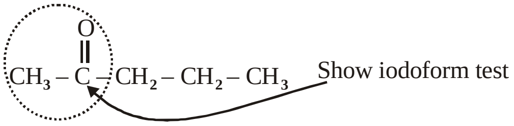
$$CH_3.CHO \xrightarrow[{[O]}]{K_2Cr_2O_7} CH_3-COOH \xrightarrow[-H_2O]{Ca(OH)_2} (CH_3-COO)_2Ca \xrightarrow{\text{distilation}} CH_3-\overset{O}{\overset{\|}{C}}-CH_3$$

$$\xrightarrow[\Delta]{\text{dil NaOH}} CH_3-\underset{CH_3}{\underset{|}{C}}=CH-\overset{O}{\overset{\|}{C}}-CH_3$$

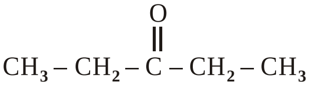
Q.16 [1]
Q.17 [5]

KVPY PREVIOUS YEAR'S

Q.1 (A)



(A) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$ Show iodoform test

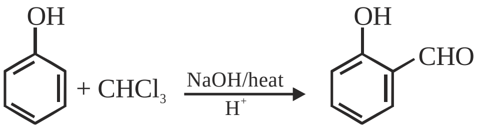


(B) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-CH_3$

(C) $CH_3-CH_2-\underset{OH}{\underset{|}{CH}}-CH_2-CH_3$

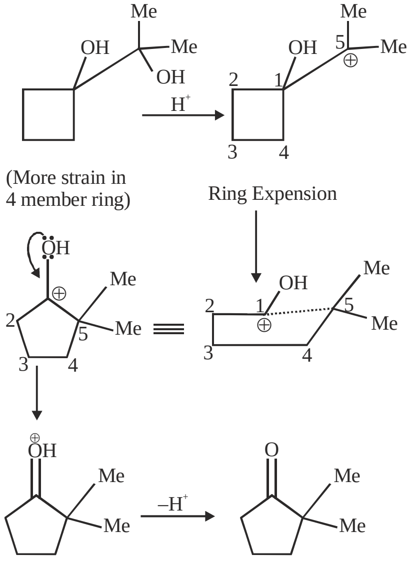
(D) $CH_3-CH_2-CH_2-CH_2-CH_2-OH$

Q.2 (C)

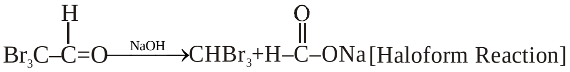


Reimer – Tiemann Reaction – Phenol react with $CHCl_3$ in presence of NaOH given product

Q.3 (C)

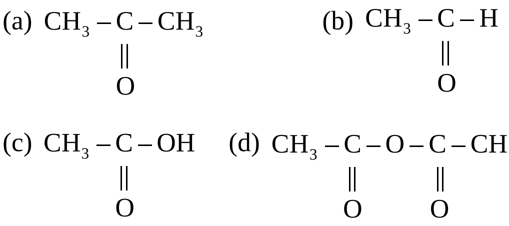


Q.4 (A)



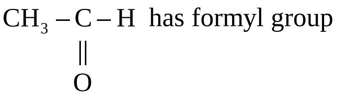
$Br_3C-\overset{H}{C}=O \xrightarrow{NaOH} CHBr_3 + H-\overset{O}{\overset{\|}{C}}-ONa$ [Haloform Reaction]

Q.5 (B)



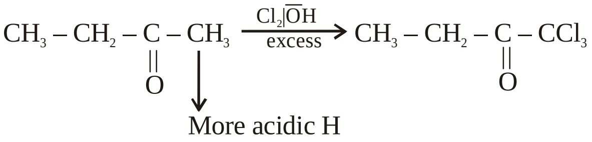
(a) $CH_3-\underset{O}{\underset{\|}{C}}-CH_3$ (b) $CH_3-\underset{O}{\underset{\|}{C}}-H$

(c) $CH_3-\underset{O}{\underset{\|}{C}}-OH$ (d) $CH_3-\underset{O}{\underset{\|}{C}}-O-\underset{O}{\underset{\|}{C}}-CH_3$



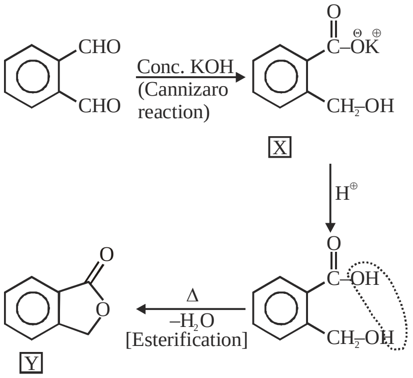
$CH_3-\underset{O}{\underset{\|}{C}}-H$ has formyl group

Q.6 (B)

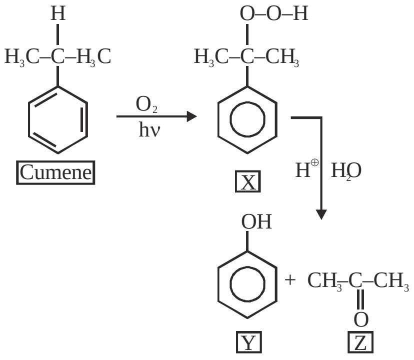


$CH_3-CH_2-\underset{O}{\underset{\|}{C}}-CH_3 \xrightarrow[\text{excess}]{Cl_2/\overline{O}H} CH_3-CH_2-\underset{O}{\underset{\|}{C}}-CCl_3$

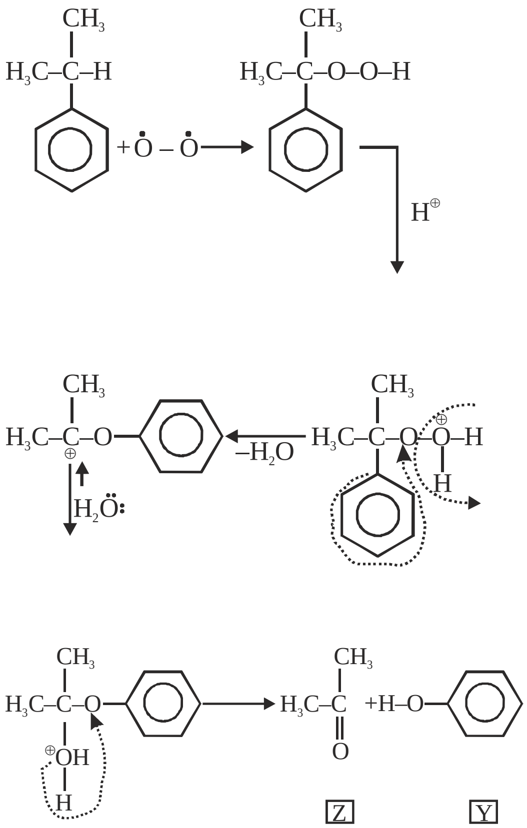
Q.7 (A)



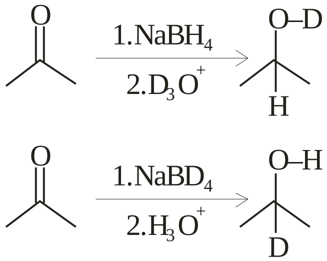
Q.8 (D)



$\text{Mech} \longrightarrow O = O \xrightarrow{h\nu} \dot{O} - \dot{O}$

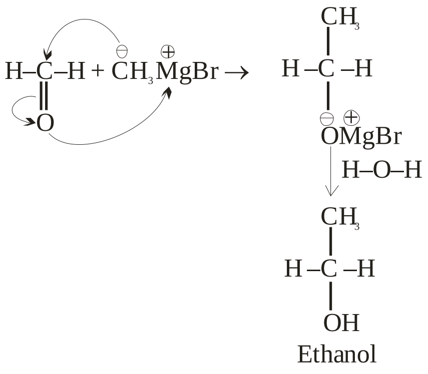


Q.9 **(A)**

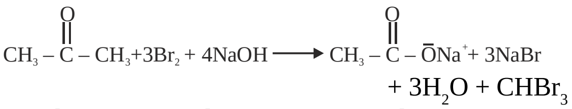


Q.10 (B)
Theoritical

Q.11 **(C)**



Q.12 (A)

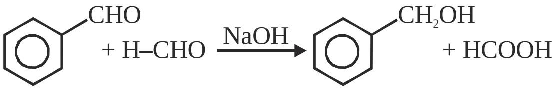


$$CH_3-\overset{O}{\overset{||}{C}}-CH_3+3Br_2+4NaOH \longrightarrow CH_3-\overset{O}{\overset{||}{C}}-\bar{O}Na^{+}+3NaBr + 3H_2O + CHBr_3$$

1 mole 1 mole 1/3 mole

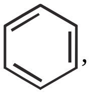
Moles of bromoform produced = 1/3 mole

Q.13 (D)

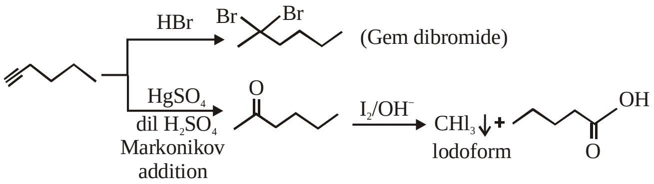


Cannizzaro reaction

Q.14 (A)

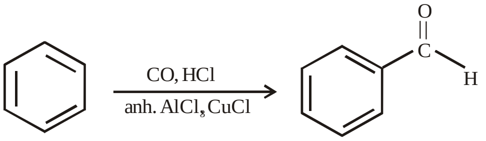
Since $NaBH_4$ does not reduce –COOH or , therefore the correct answer is (A).

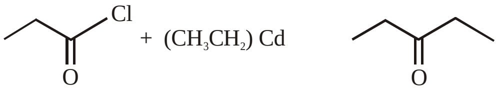
Q.15 **(D)**

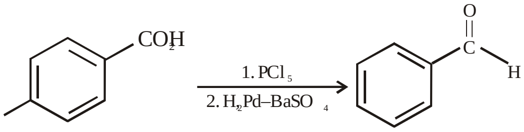


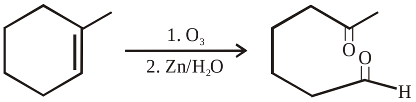
Q.16 **(D)**

Only Aliphatic aldehydes forms a reddish brown precipitate when subjected to Fehling's test.

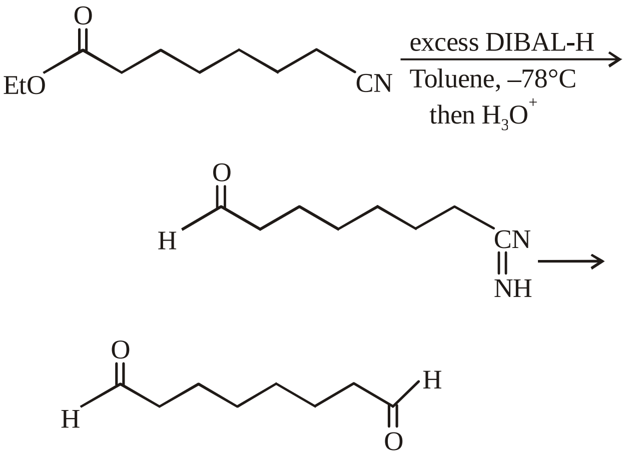
(A) 

(B) 

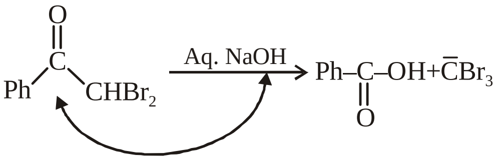
(C) 

(D) 

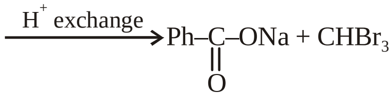
Q.17 (A)



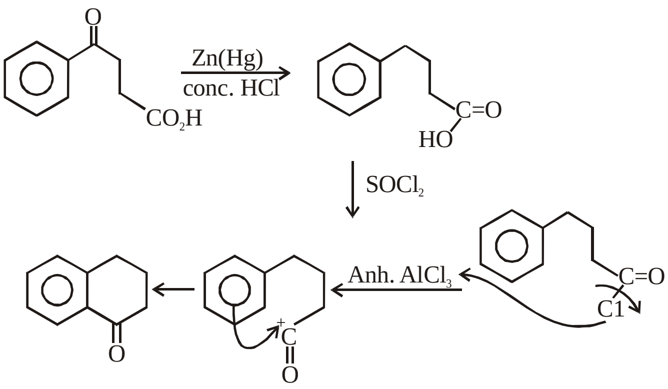
Q.18 (B)



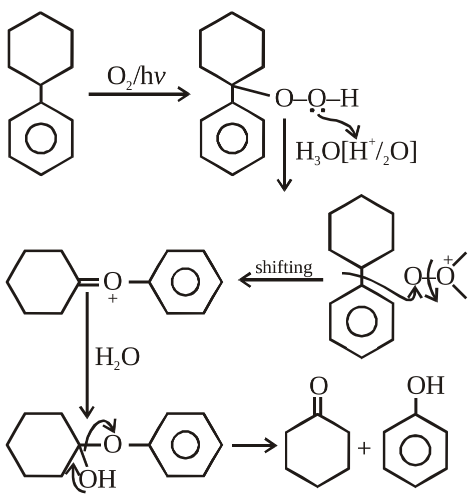
(Haloform reaction)



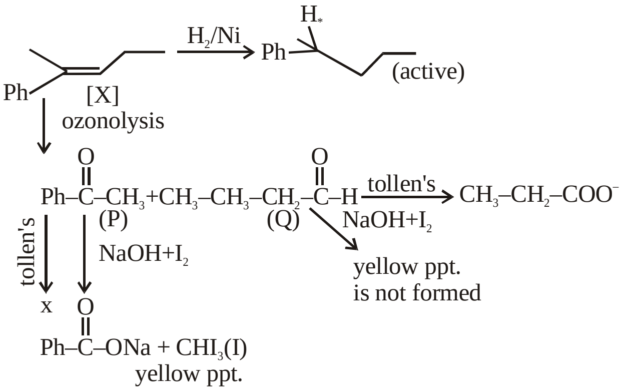
Q.19



Q.20 (D)



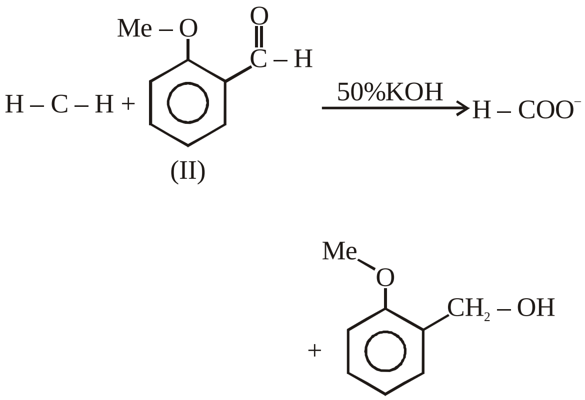
Q.21 (A)

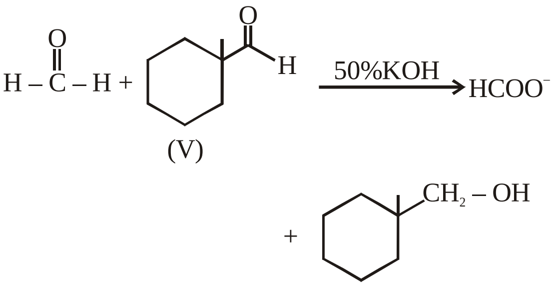


Q.22 (A)

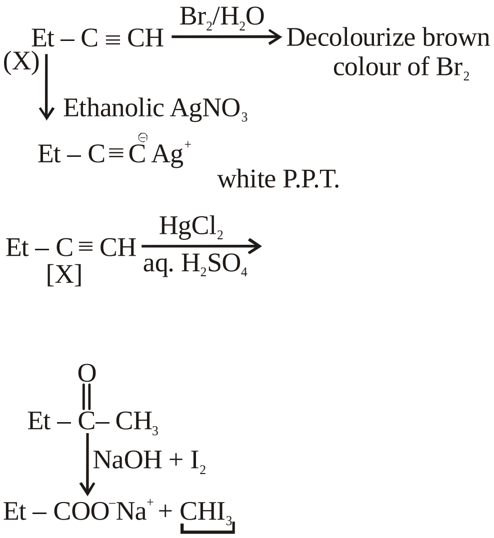
Aldehyde without a-H give Cannizaro reaction.

In Cannizaro reaction alcohol and carboxylic acid salt is formed.





Q.23 (D)



$$\begin{tikzcd} \underset{(X)}{Et-C\equiv CH} \arrow[r, "Br_2/H_2O"] \arrow[d, "\text{Ethanolic } AgNO_3"] & \text{Decolourize brown colour of } Br_2 \\ Et-C\equiv\overset{\ominus}{C}\,Ag^+ \text{ white P.P.T.} & \end{tikzcd}$$

$$\underset{[X]}{Et-C\equiv CH}\xrightarrow[\text{aq. }H_2SO_4]{HgCl_2}$$

$$\begin{tikzcd} Et-\overset{O}{\overset{\|}{C}}-CH_3 \arrow[d, "NaOH + I_2"] \\ Et-COO^-Na^+ + \underline{CHI_3} \end{tikzcd}$$

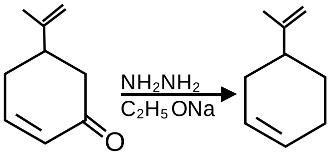
JEE-MAINS
PREVIOUS YEAR'S

Q.1 (4)

It is intramolecular aldol condensation reaction.

Q.2 (1)

Q.3 (1)



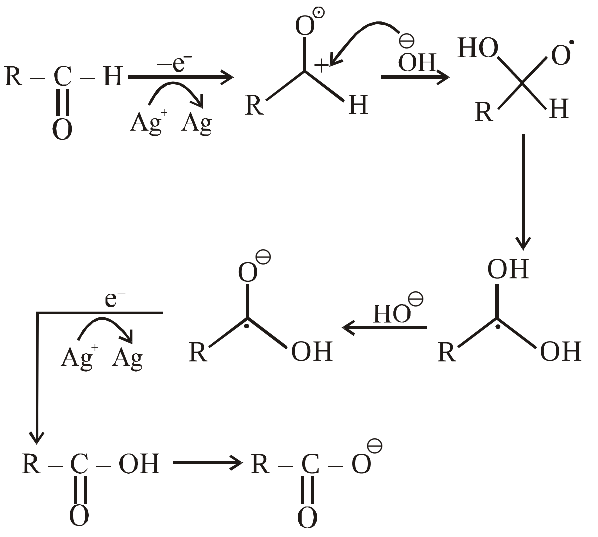
it is wolff-Kishner reduction of carbonyl compounds.

Q.4 **(2)**

$AgNO_3 + NaOH \rightarrow AgOH + NaNO_3$

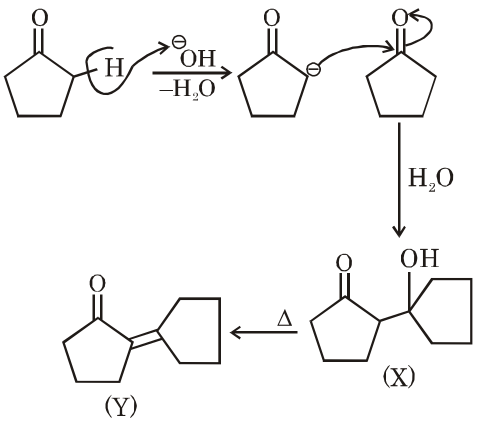
$2AgOH \rightarrow Ag_2O + H_2O$

$Ag_2O + 4NH_3 + H_2O \rightarrow 2Ag(NH_3)_2^+ + 2\overset{\ominus}{O}H$



Total 2e⁻ transfer to Tollen’s reagent

Q.5 **(3)**



Q.6 **(3)**

Q.7 **(3)**

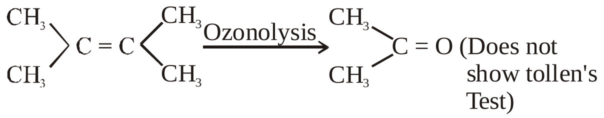
$$\underset{\text{Unsaturated Hydrocarbon}}{(X)} \xrightarrow{\text{Ozonolysis}} (A) \xrightarrow[\text{AgNO}_3 \text{ (Tollen's regent)}]{\text{Ammonical}} \underset{\text{silver mirror}}{Ag\downarrow}$$

As (A) compound given positive tollen's test hence it may consist −CHO (aldehyde group). or it can be HCOOH

So for the given option :

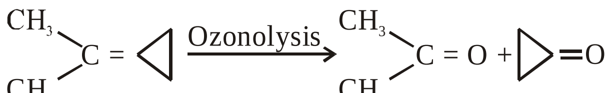
$$CH_3-CH_2-C\equiv CH \xrightarrow{\text{Ozonolysis}} \underset{\text{(A) +ve tollen's test}}{CH_3CH_2COOH+HCOOH}$$

and for other compounds (options):

(1) 

$$(CH_3)_2C=C(CH_3)_2 \xrightarrow{\text{Ozonolysis}} (CH_3)_2C=O$$

(Does not show tollen's Test)

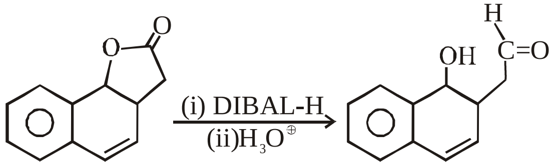
(2) 

(Both do not show tollen's test)

(3) $CH_3-C\equiv C-CH_3 \xrightarrow{\text{Ozonolysis}} 2CH_3-COOH$

(Does not show tollen's test)

Q.8 **(2)**



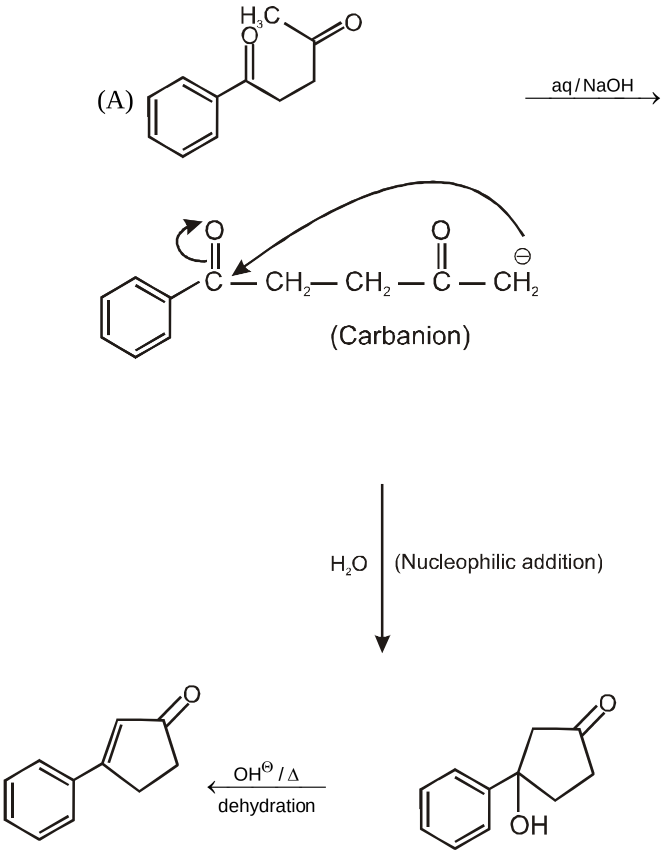
DIBAL can not reduce double bond
It can reduce cyclic ester.

Q.9	**(3)**
Q.10	(2)
Q.11	(4)
Q.12	(3)
Q.13	(1)
Q.14	(1)
Q.15	(4)
Q.16	(3)
Q.17	**(3)**
Q.18	(1)
Q.19	(1)
Q.20	**(3)**
Q.21	(2)

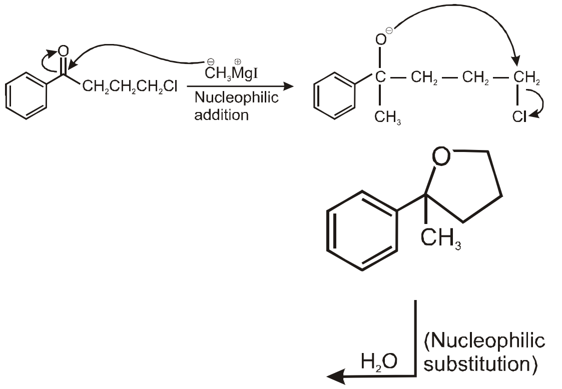
JEE-ADVANCED
PREVIOUS YEAR'S

Q.1 (A-r, s, t) ; (B-p, s) ; (C-r, s) ; (D-q, r)

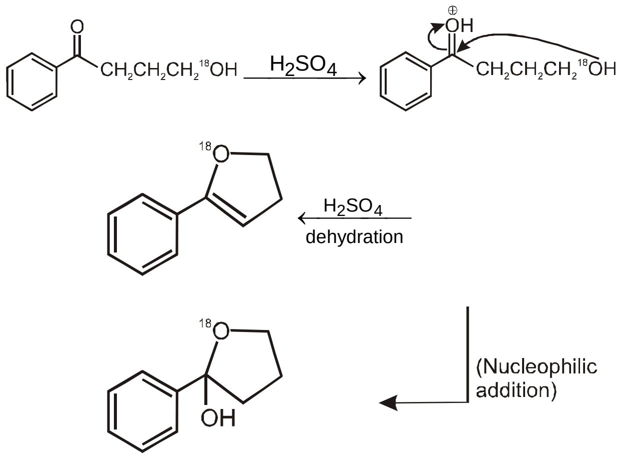
(A)



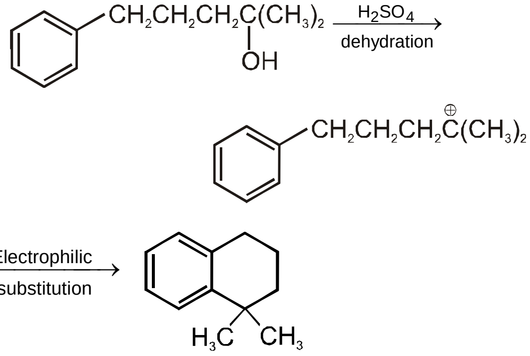
(B)



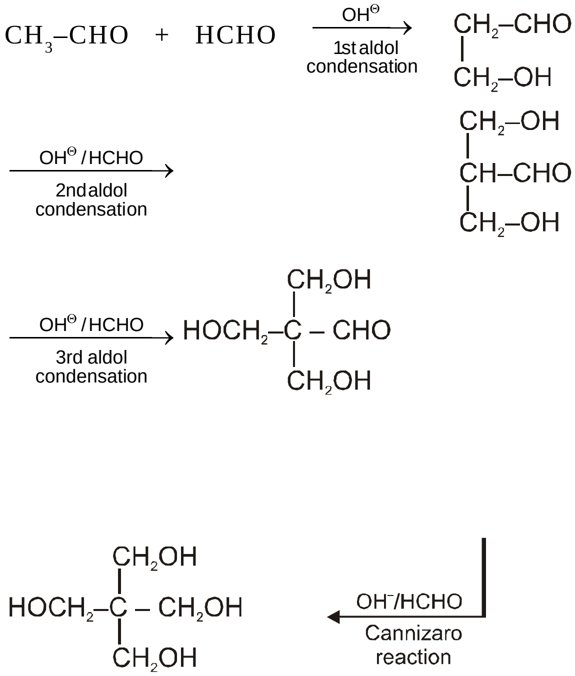
(C)



(D)

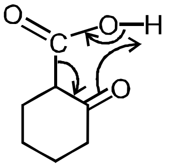


Q.2 **(C)**

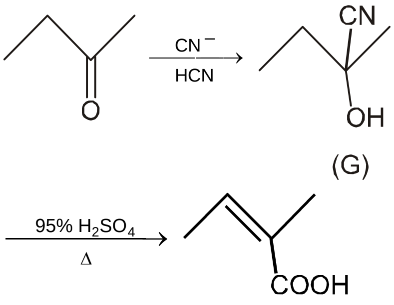


Q.3 **(B)**

In decarboxylation, β-carbon acquires δ– charge. Whenever δ– charge is stabilized, decarboxylation becomes simple. In (B), it is stabilized by –m & –I of C = O, which is best amongst the options offered,



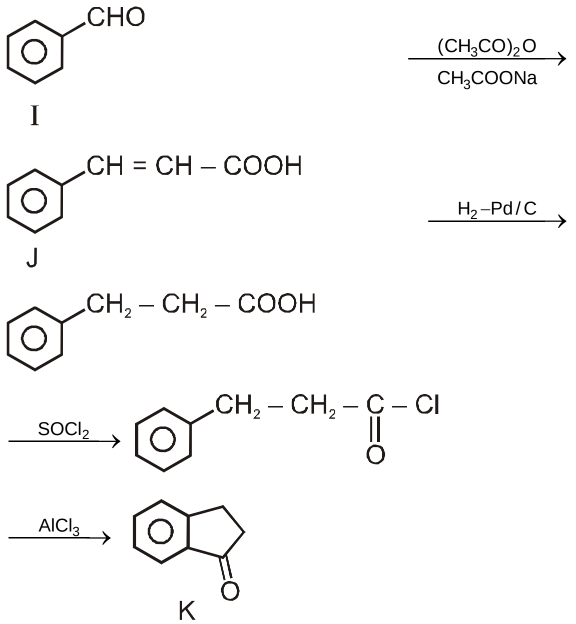
Q.4 **(A)**



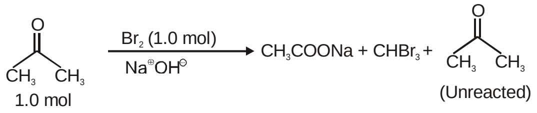
Q.5 (C)

Q.6 (A)

(5 to 6)

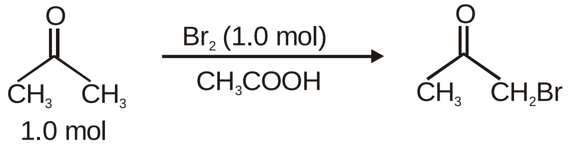


Q.7 Reaction I :



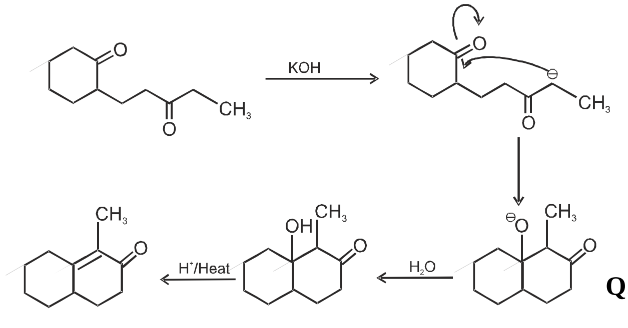
(In basic medium complete haloform reaction takes place since the rate of reaction increases with each α-halogenation)

Reaction II :

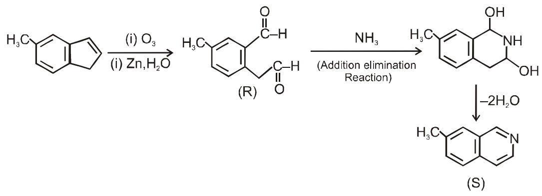


(In acidic medium monohalogenation takes place with 1-mol of halogen)

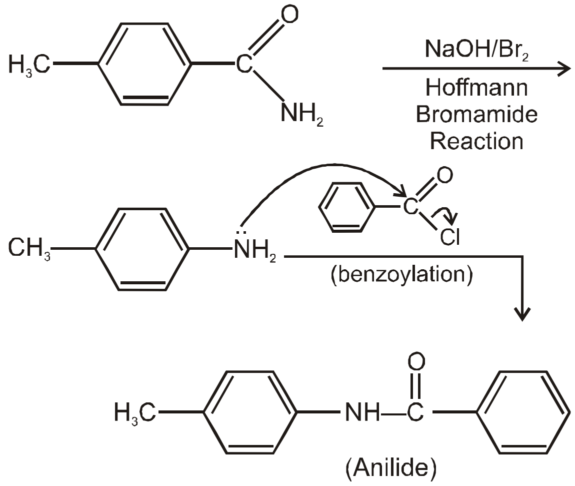
Q.8 (A)



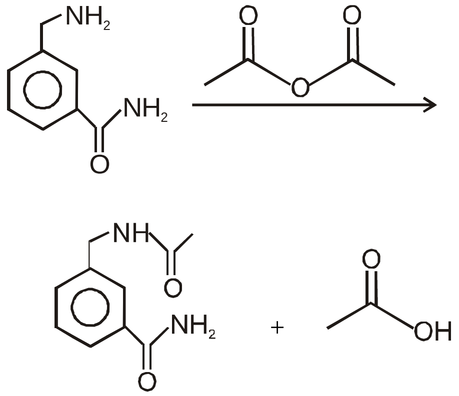
Q.9 (A)



Q.10 (C)



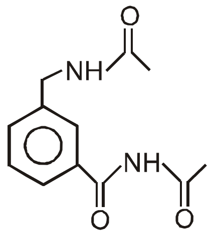
Q.11 (A)



since $-CH_2 - NH_2$ is more basic.

The resulting amide will fail to react further. Had it been possible, imied formation would have occured at both the sites.

∴



also results.

Q.12 (D)

Substitution reaction of toluene takes place through radical mechanism.

Q.13 **(A**

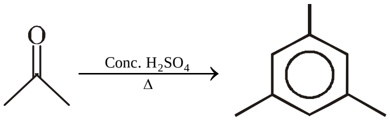
Haloform reaction of acetophenone yields benzoic acid.

Q.14 **(D)**

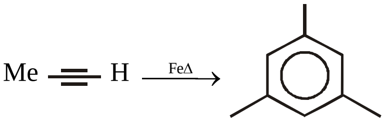
Perkin condensation of benzaldehyde with $(CH_3CO)_2O/CH_3COOK$ yields cis and trans form of cinnamic acid.

Q.15 (A,B,D)

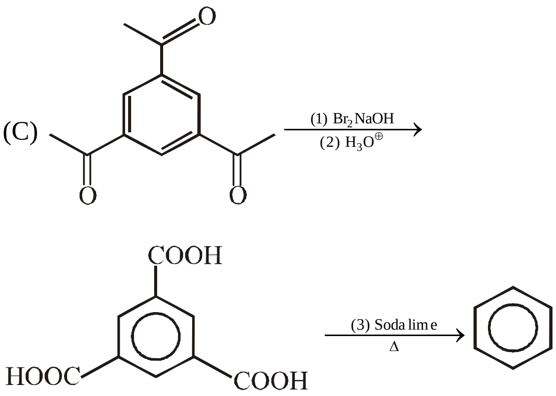
(A)



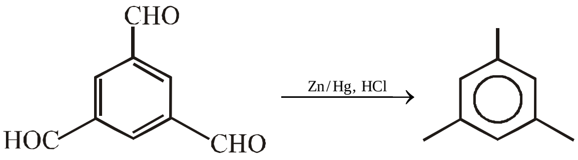
(B)



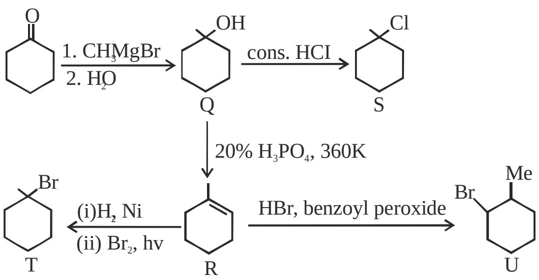
(C)



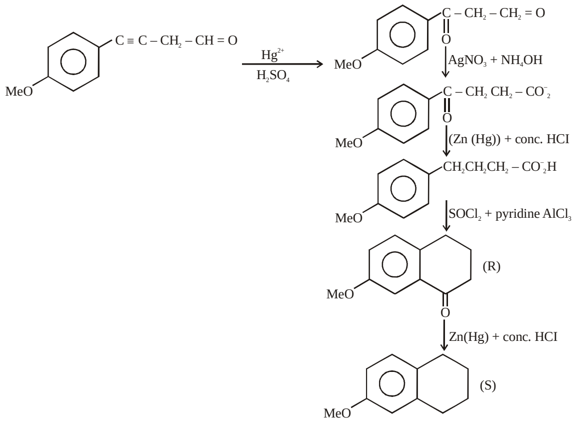
(D)



Q.16 (B)

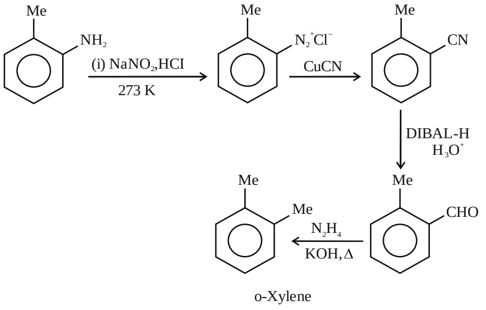


Q.17 (B, D)

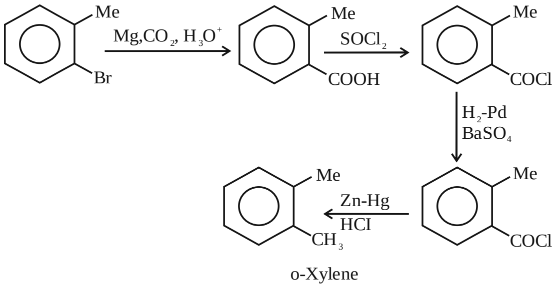


Q.18 A, B

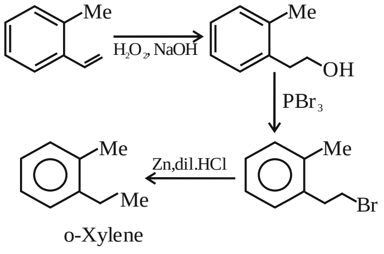
(A)



(B)

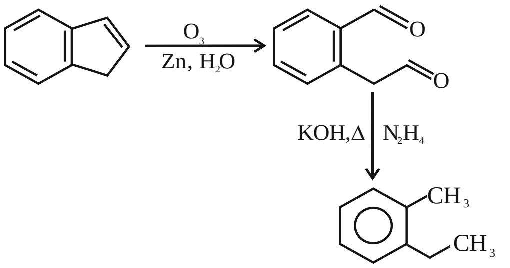


(C)



is not formed

(D)



o-Xylene is not formed

Q.19 [12]