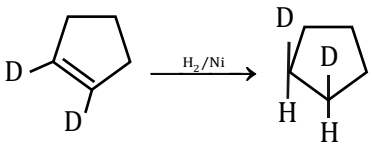
Hydrocarbons

SOLUTIONS

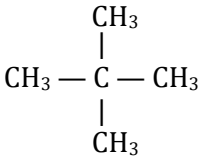
EXERCISE - O

1. **Ans. (B)**

Catalytic hydrogenation proceeds through syn addition mechanism.



2. **Ans. (C)**



Neopentane

→ central carbon atom is bonded by 4 methyl groups and as hydrogenation involves addition of hydrogen so for no alkene it is possible to form neopentane using hydrogenation.

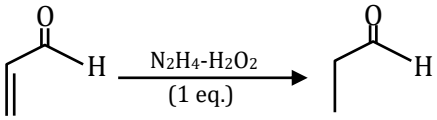
3. **Ans. (B)**

$CH_3—C\equiv CH + 2H_2 \xrightarrow{Pt} CH_3CH_2CH_3$

(proceeds via $CH_3 - \underset{H}{\overset{|}{C}} = \underset{H}{\overset{|}{C}} - H$)

4. **Ans. (B)**

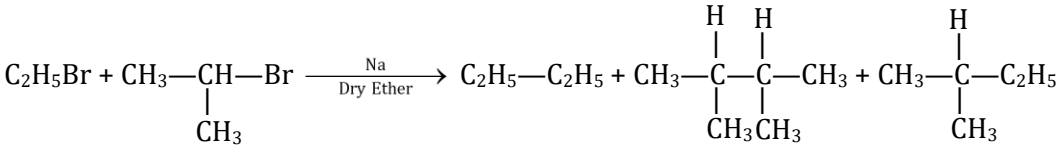
Di-imide reduction only reduce C = C and symmetrical double bond.



5. **Ans. (D)**

$CH_3—I + CH_3—CH_2—I \xrightarrow[\text{Dry Ether}]{Na} CH_3—CH_3 + CH_3—CH_2—CH_2—CH_3 + CH_3—CH_2—CH_3$

6. **Ans. (D)**



7. **Ans. (C)**

Reduction of Alkyl halide (except fluorides) produces alkane with zinc and dilute hydrochloric acids.

8. **Ans. (C)**

Corey – House synthesis reaction

$R — X + Li \rightarrow RLi \xrightarrow{Cu_2I_2} R_2CuLi \xrightarrow{R'-X} R' - R$

9. **Ans. (A)**

$RMgX \xrightarrow{H_2O} R-H+Mg(OH)X$

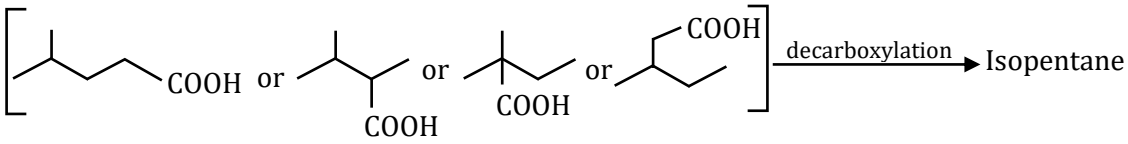
10. **Ans. (A)**

At cathode (Reduction)

$2H_2O + 2e^{\ominus} \rightarrow 2OH^{\ominus} + 2H^{\bullet}, 2H^{\bullet} \longrightarrow H_2\uparrow$

Due to release of $OH^{\ominus}$ ion, pH increases as the reaction proceeds.

11. **Ans. (D)**



12. **Ans. (C)**

More is the branching lesser is the boiling point.

13. **Ans. (A)**

Compound (iii) is more stable because of less steric repulsion. Therefore, have least heat of combustion

14. **Ans. (C)**

The melting point of even number of C atoms is greater than the next lower and next higher C atom

15. **Ans. (D)**

C_1—C_4 are gases, C_5—C_{17} are liquids, and C_{18} onwards are colourless waxy solids.

16. **Ans. (B)**

Straight-chain compound has knocking property (making more rattling sound).

17. **Ans. (C)**

$Cl-Cl \xrightarrow{h\nu} 2\dot{C}l$ (Homolysis)

Photochemical chlorination of alkanes is a free radical process and the reaction is initiated by homolysis of halogens to form free radicals.

18. **Ans. (B)**

Reactivity $\propto$ stability of free radical formed.

$\therefore$ Order of stability of free radical formed : $3° > 2° > 1° > CH_3$

19. **Ans. (A)**

C–F > C–Cl > C–Br > C–I

In halogenation of alkanes, the mechanism is radical mechanism. As we go from F_2 to I_2 the energy released in the propagating steps decreases.

20. **Ans. (C)**

Chain termination step

$\dot{C}l + \dot{C}l \longrightarrow Cl_2$

$\dot{C}H_3 + \dot{C}l \longrightarrow CH_3 - Cl$

$\dot{C}H_3 + \dot{C}H_3 \longrightarrow CH_3 - CH_3$

21. Ans. (C)

$$CH_3CH_2CH_2CH_3 \xrightarrow{\text{Cracking}} C{=}C{-}C{-}C + C{-}C{=}C{-}C + C{-}C{=}C + C{=}C + C{-}C + CH_4 + H_2$$

22. Ans. (C)

Alkane $\quad C_nH_{2n+2} + \left(\frac{3n+1}{2}\right)O_2 \longrightarrow nCO_2 + (n+1)H_2O$

Alkene $\quad C_nH_{2n} + \left(\frac{3n}{2}\right)O_2 \longrightarrow nCO_2 + nH_2O$

Alkyne $\quad C_nH_{2n-2} + \left(\frac{3n-1}{2}\right)O_2 \longrightarrow nCO_2 + (n-1)H_2O$

All hydrocarbons, saturated or unsaturated on complete combustion always produces CO_2 and H_2O.

23. Ans. (D)

$$\underset{\text{n-hexane}}{CH_3(CH_2)_4CH_3} \xrightarrow[600^\circ C]{Cr_2O_3/Al_2O_3} \underset{\text{Benzene}}{\bigcirc} + 4H_2$$

(Aromatization Or Hydroformation Or cyclisation)

24. Ans. (D)

$$\underset{\text{(n-butane)}}{CH_3{-}CH_2{-}CH_2{-}CH_3} \xrightarrow[\Delta]{AlCl_3+HCl} \underset{\text{(Isobutane)}}{CH_3{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}{-}CH_3}$$

25. Ans. (D)

Pyrolysis of alkanes is a free radical elimination reaction.

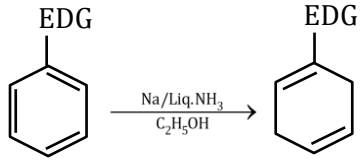
26. Ans. (D)

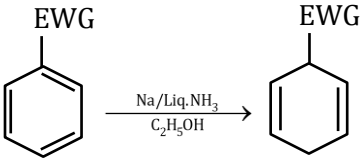
All hydrocarbons, saturated or unsaturated on complete combustion always produces CO_2 and H_2O.

27. Ans. (A)

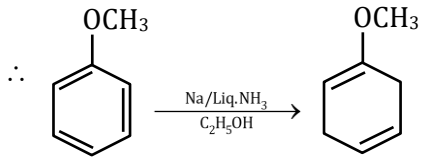
$$CH_3CH_2{-}C{\equiv}C{-}(CH_2)_3{-}COOH \xrightarrow[\text{S-quinoline}]{H_2,\text{Pd-BaSO}_4} \underset{\text{Cis-alkene}}{\overset{CH_3CH_2}{\overset{|}{}}\!\!>\!C{=}C\!<\!\overset{(CH_2)_3COOH}{\overset{|}{}}\atop H \qquad H}$$

28. Ans. (A)



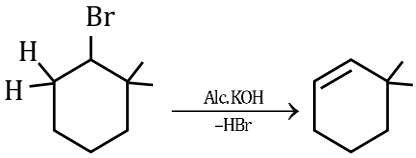


$\because$ $-OCH_3$ is Electron donating group.

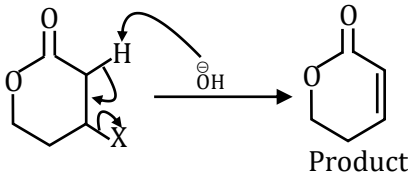


29. Ans. (A)

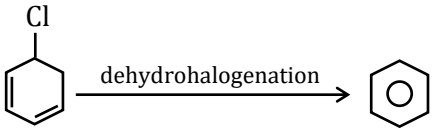
In E_2 elimination, β-H is abstracted.



30. Ans. (B)



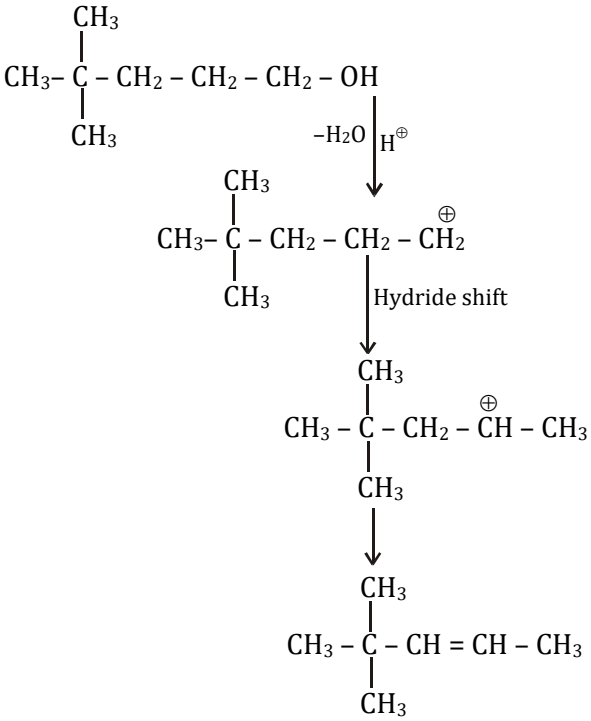
31. Ans. (A)



Benzene (aromatic)
Highly stable

When a stable product is formed that means dehydrohalogenation becomes very easy.

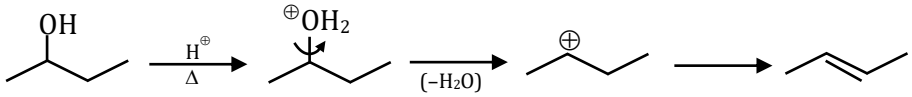
32. Ans. (B)



33. Ans. (B)

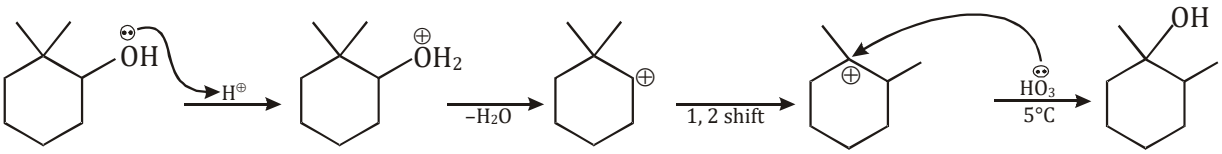
The order of acid catalysed elimination of alcohol follows the order : 3° > 2° > 1°

34. Ans. (A)



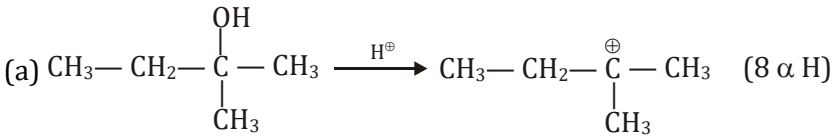
(sec. butyl alcohol) (Saytzeff product)

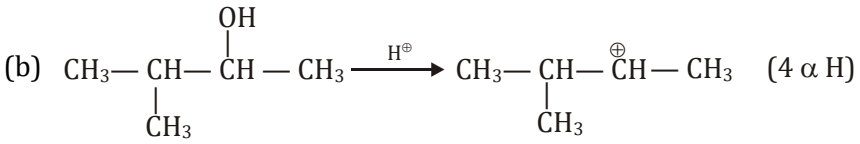
35. Ans. (D)

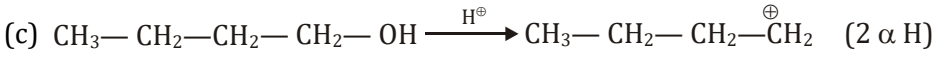


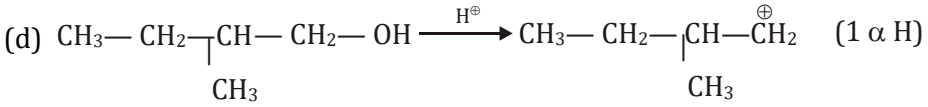
No elimination as heat is not given

36. Ans. (A)

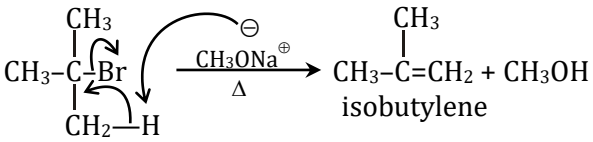




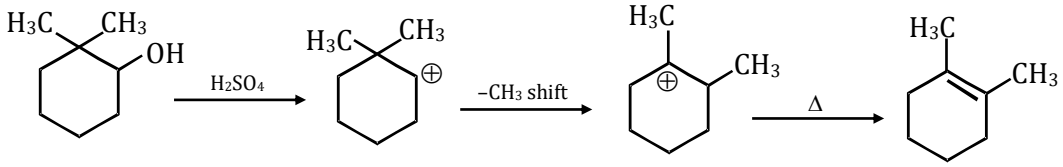




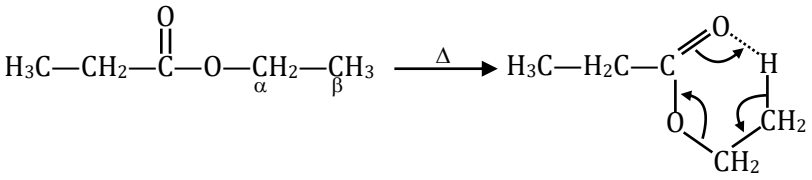
37. Ans. (C)



38. Ans. (B)

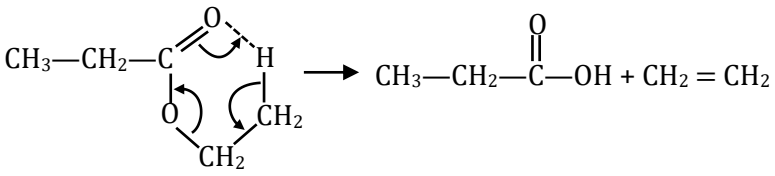


39. Ans. (B)

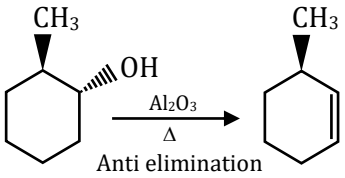


(6 membered cyclic transition state)

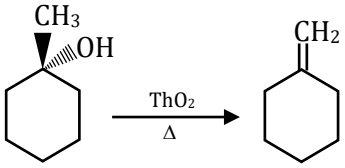
40. Ans. (B)



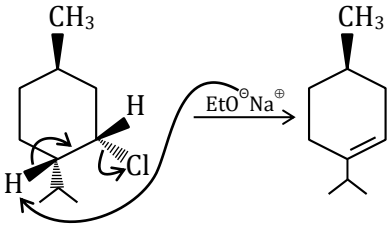
41. Ans. (A)



42. Ans. (B)



43. Ans. (A)



44. Ans. (A)

In the cis isomer, both the bulky groups are present on the same side, hence it has a dipole moment (which gets cancelled out in case of trans) thus cis-but-2-ene has a higher dipole moment due to which it is more ionic, hence higher boiling point.

45. Ans. (C)

M.P $\propto$ Symmetry

$\propto$ effective packing

p-xylene has the highest melting point because p-xylene being symmetrical, packs closely in the crystal lattice.

46. Ans. (B)

Like dissolve like

Polarity of different hydrocarbon : Alkyne > Alkene > Alkane.

$\therefore$ Solubility : Alkane > Alkene > Alkynes

47. Ans. (C)

$\Rightarrow$ Alkene are insoluble in water but fairly soluble in nonpolar solvents like benzene, ether etc.

$\Rightarrow$ Branching decreases B.P

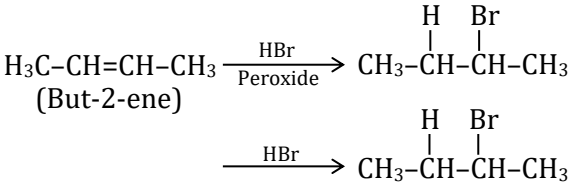
48. Ans. (B)

$$\text{Heat of Hydrogenation} \propto \frac{1}{\text{Stability of alkene}}$$

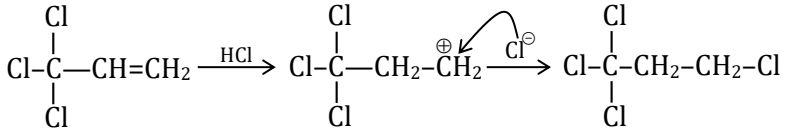
Heat of hydrogenation is directly related to stability of alkene i.e. more is the stability of alkene smallest is the heat of hydrogenation per mole. Among the given molecules Symmetrical alkenes are highly stable. Furthermore, Trans-2-butene is more stable than cis-2-butene because in trans-2-butene the bulky methyl groups are far apart whereas in cis-2-butene the bulky groups are crowded together hence there are stearic repulsions. Hence, trans-2-butene has the smallest heat of hydrogenation per mole.

49. Ans. (B)

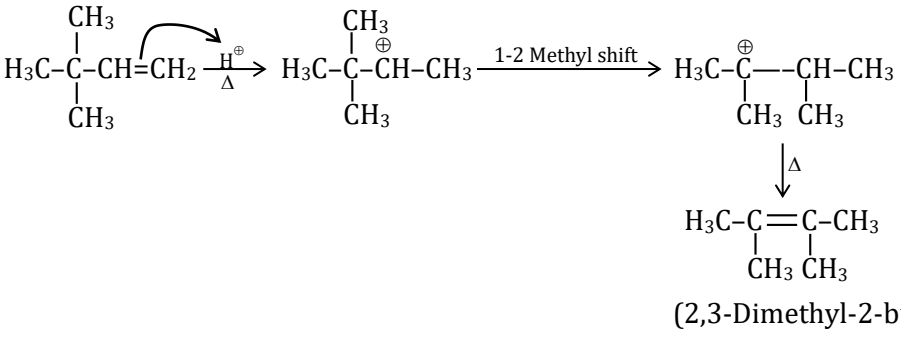
Anti markovnikov addition of HBr is not observed in but-2-ene, as it is symmetrical molecule across double bond.



50. Ans. (A)

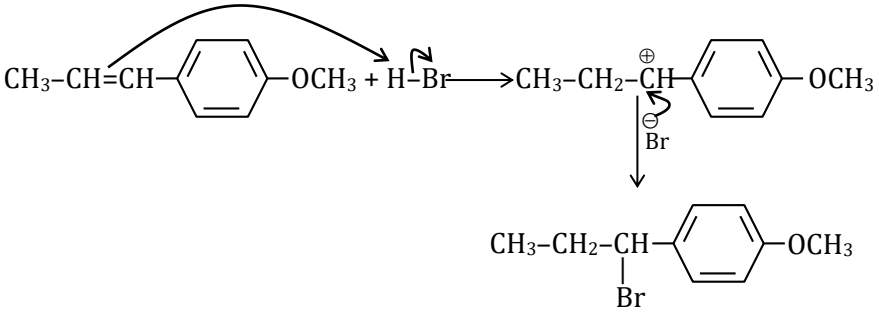


51. Ans. (D)

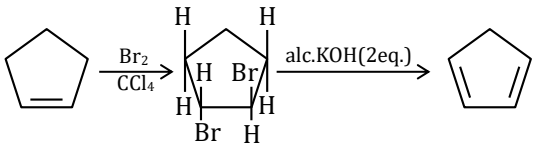


(2,3-Dimethyl-2-butene)

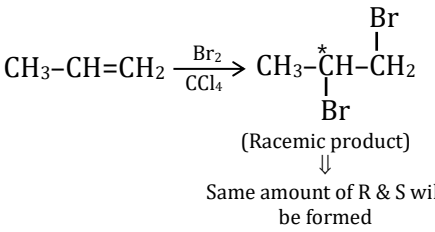
52. Ans. (C)



53. Ans. (D)



54. Ans. (D)

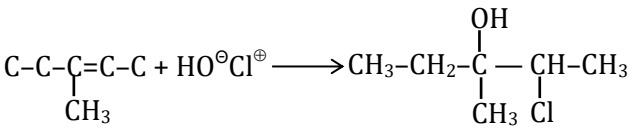


⇒ Reaction completes with anti addition mechanism.

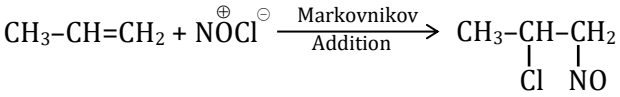
⇒ Reaction can be used as a test for unsaturation

55. Ans. (C)

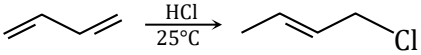
Addition takes place according to Markovnikov rule :



56. Ans. (A)

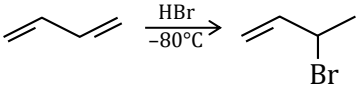


57. Ans. (A)



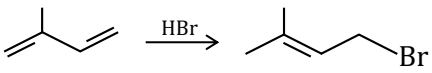
Thermodynamic controlled product obtained.

58. Ans. (D)



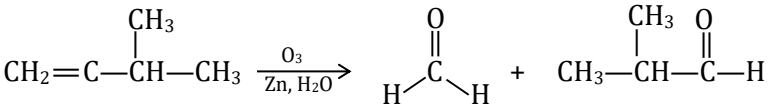
Kinetic controlled Product obtained, because temperature is very low.

59. Ans. (B)



Thermodynamically controlled product.

60. Ans. (C)



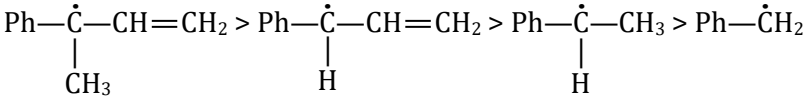
61. Ans. (D)

Ozonolysis, a reaction used in organic chemistry to determine the position of a carbon – carbon double bond in unsaturated compounds.

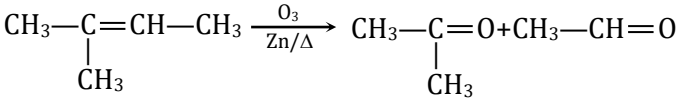
62. Ans. (D)

Reactivity towards NBS $\propto$ stability of carbon free-radical.

Stability order :

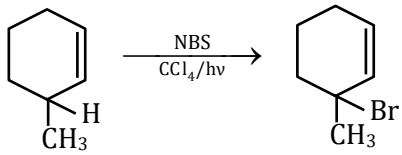


63. Ans. (D)

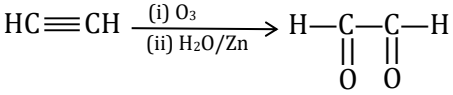


(Acetone)

64. Ans. (A)



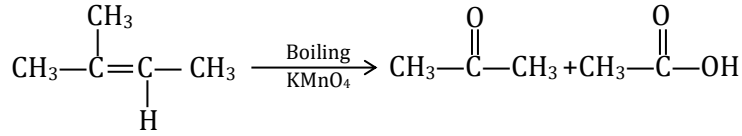
65. Ans. (C)



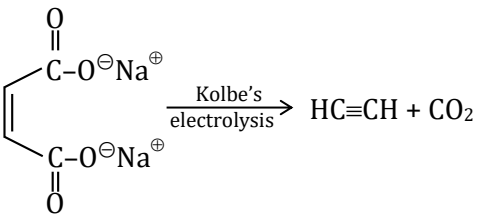
Glyoxal

66. Ans. (A)

Boiling $KMnO_4$ acts as strong O.A.



67. Ans. (C)

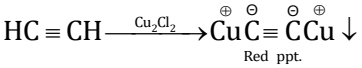


68. Ans. (B)

1% alkaline $KMnO_4$ decolourise terminal alkyne.

Propyne ($H_3C - C \equiv CH$) is terminal alkyne so (B) is correct.

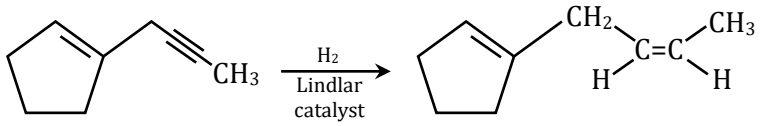
69. Ans. (C)



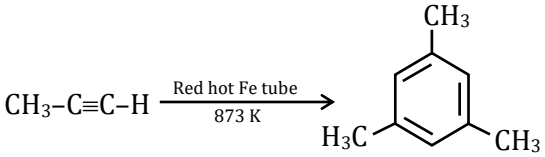
70. Ans. (C)

Cu_2Cl_2 doesn't react with internal alkyne.

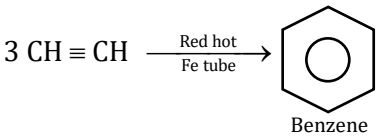
71. Ans. (A)



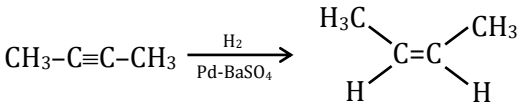
72. Ans. (A)



73. Ans. (A)

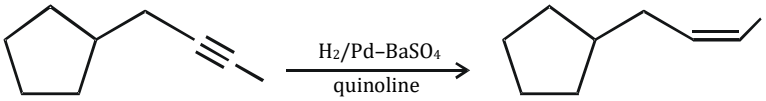


74. Ans. (A)



(Syn addition)

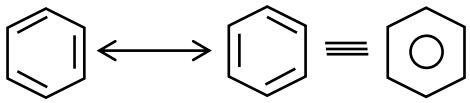
75. Ans. (B)



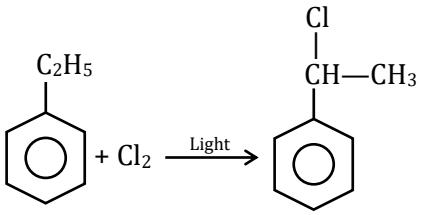
(Syn addition)

76. Ans. (C)

In Kekule's structure, the carbon atoms in benzene are arranged in a hexagonal ring with each carbon atom is attached to two other carbon atoms. The ring contains alternate single and double bond. These double bonds are due to the π electrons present in benzene. These π electrons can delocalize and form two structures with different position of a double bond. These are the resonance contributor. Thus they contribute equally to form a resonance hybrid.



77. Ans. (B)



78. Ans. (D)

$-NH_2$, $-OH$, $-X$ } o, p-directing group

$-CHO \rightarrow$ m-directing group

79. Ans. (D)

Z = $-NHCOCH_3$, $—CH_3$ (both are ortho/para directing)

80. Ans. (A)

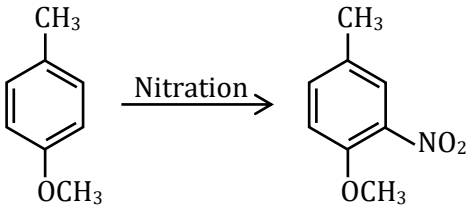
–COOH group has its negative resonance effect as it tries to pull the electrons out of the ring.

So meta product will be formed, as ortho and Para product will be unstable.

81. Ans. (B)

Chlorine and nitro group deactivate the benzene ring towards electrophilic aromatic substitution reaction. Methyl group activates the benzene ring towards electrophilic aromatic substitution reaction. Hence, the reaction of SO_3 is easier in toluene.

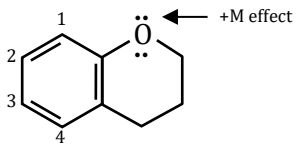
82. Ans. (B)



83. Ans. (A)

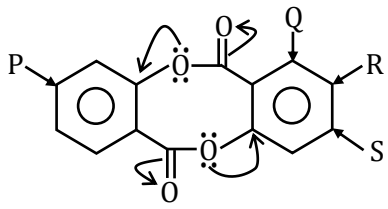
Electrophilic substitution reactions is the characteristic reaction of benzene ring in the presence of [$AlCl_3$ + Cl_2].

84. Ans. (C)



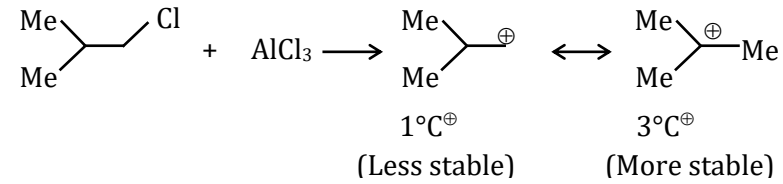
Position (3) is at para position w.r.t. the group. There substitution take place at position (3).

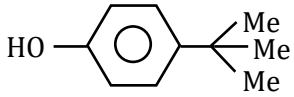
85. Ans. (C)



Position (R) is p-position w.r.t. EDG ($—\ddot{O}—$) group.

86. **Ans. (B)**



Product is: 

87. **Ans. (C)**

Sulphonation is a reversible process and shows 1° kinetic isotope effect, whereas other electrophilic substitution reactions (i.e. nitration halogenation, etc.) do not show 1° kinetic isotope effect.

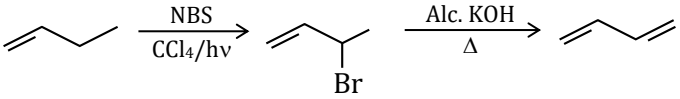
88. **Ans. (B)**

Sulphonation is a reversible process and shows 1° kinetic isotope effect, whereas other electrophilic substitution reactions (i.e. nitration halogenation, etc.) do not show 1° kinetic isotope effect.

89. **Ans. (D)**

Propene ($CH_3 - CH = CH_2$) is expected to react most readily with bromine. Alkenes are more reactive than alkanes or alkynes. Also alkenes substituted with electron releasing alkyl groups are more reactive than unsubstituted alkenes.

90. **Ans. (B)**



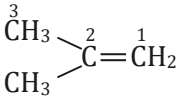
91. **Ans. (B)**

The unsaturated compounds which on reaction with HX acid forms stable carbocation will be most reactive.

92. **Ans. (B)**

Monomer of polypropylene is propene ($CH_3 — CH = CH_2$)

93. **Ans. (C)**



2-methylpropene.

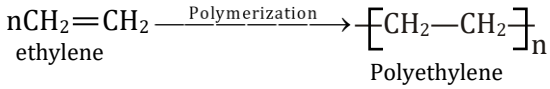
94. **Ans. (D)**

Natural Rubber is the polymer of isoprene

95. **Ans. (C)**

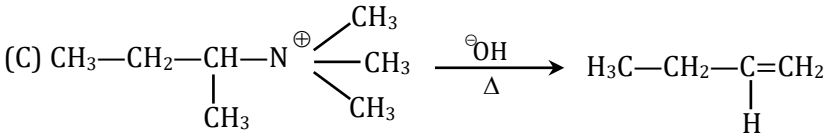
The catalyst used in the manufacture of polyethene by Zeigler-Natta method is $TiCl_4$ (titanium tetrachloride) and $(C_2H_5)_3Al$ (triethylaluminium).

96. **Ans. (B)**

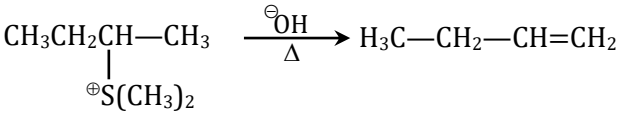


97. Ans. (A,C,D)

(A) $tBuO^{\ominus}K^{\oplus}$ is a bulky base which favours Hoffmann elimination

(C) 

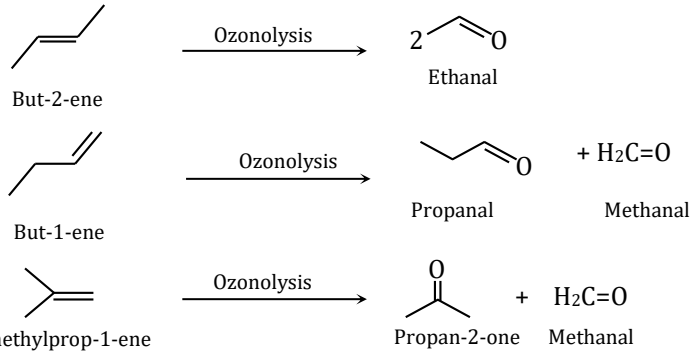
Hoffmann product

(D) 

Hoffmann product

98. Ans. (A,C)

But -2-ene on ozonolysis yields only ethanol the isomer of this alkene on ozonolysis yields propan-2-one and methanal.



99. Ans. (C, D)

(A) $Mg_2C_3 + H_2O \longrightarrow Mg(OH)_2 + CH_3C{\equiv}CH$

(B) $CaC_2 + H_2O \longrightarrow Ca(OH)_2 + HC{\equiv}CH$

(C) $Be_2C + H_2O \longrightarrow Be(OH)_2 + CH_4$

(D) $Al_4C_3 + H_2O \longrightarrow Al(OH)_3 + CH_4$

100. Ans. (B, C)

$$CaC_2 + H_2O \longrightarrow H-C\equiv C-H + Ca(OH)_2$$

$$Mg_2C_3 + H_2O \longrightarrow Mg(OH)_2 + CH_3-C\equiv CH$$

EXERCISE - S

1. Ans. (4)

1. $\dot{C}H_3 + \dot{C}H_3 \longrightarrow CH_3-CH_3$

2. $\dot{C}H_3 + \dot{C}_2H_5 \longrightarrow CH_3-CH_2-CH_3$

3. $\dot{C}_2H_5 + \dot{C}_2H_5 \longrightarrow CH_3-CH_2-CH_2-CH_3$

4. $\dot{C}_2H_5 + \dot{C}_2H_5 \xrightarrow{\text{Disproportionation}} CH_2=CH_2 + CH_3-CH_3$

2. Ans. (2)

$CH_3-CH_2-CH_2-CH_2-MgBr \xrightarrow{ROH} CH_3-CH_2-CH_2-CH_3$

$CH_3-\underset{\underset{MgBr}{|}}{CH_2}-CH_2-CH_3 \xrightarrow{ROH} CH_3-CH_2-CH_2-CH_3$

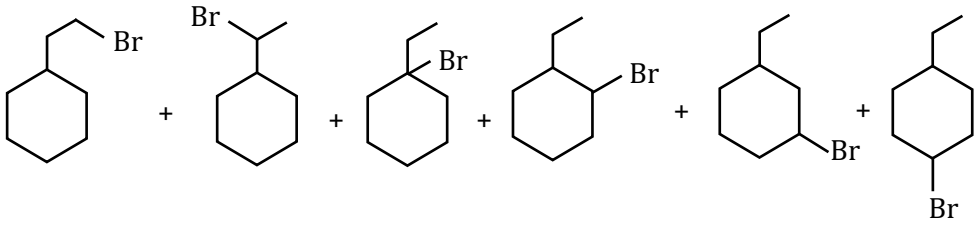
3. Ans. (5)

$C_nH_{2n+2} + \left(\frac{3n+1}{2}\right)O_2 \longrightarrow nCO_2 + (n+1)\,H_2O$

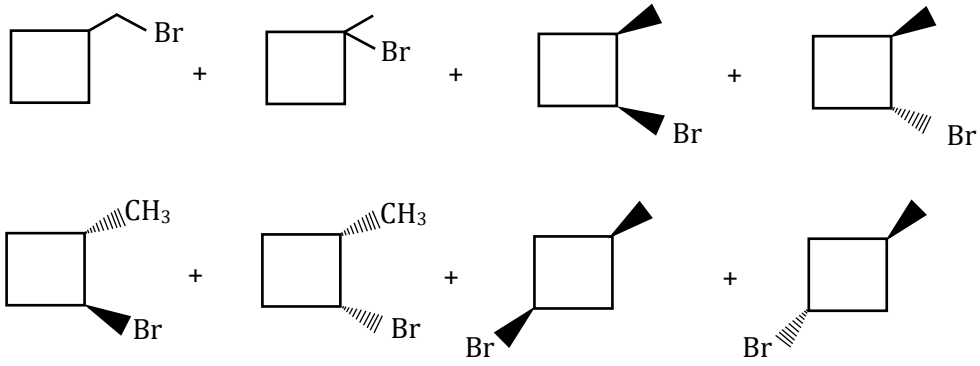
For propane n = 3

$\therefore$ number of moles of O_2 required = $\frac{3n+1}{2} = \frac{3\times3+1}{2} = 5$

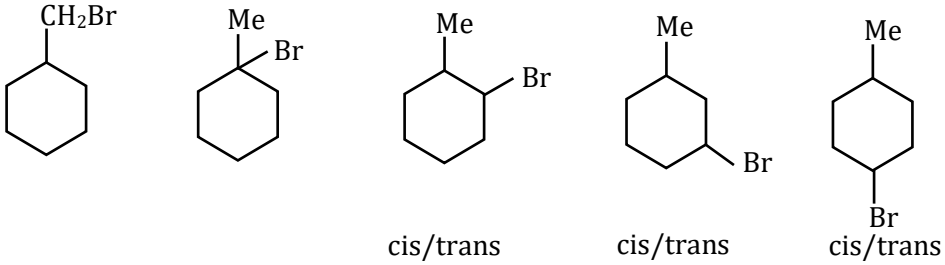
4. Ans. (6)



5. Ans. (8)



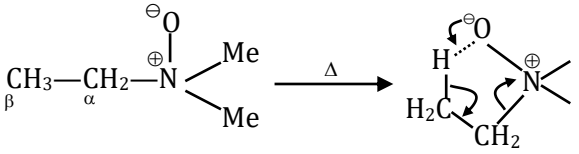
6. Ans. (5)



cis/trans cis/trans cis/trans

Number of isomers (excluding stereoisomers) = 5

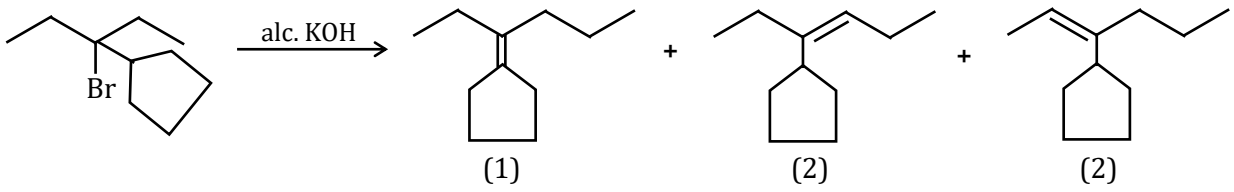
7. Ans. (5)



(5-membered cyclic T.S.)

8. Ans. (5)

The alkenes formed are

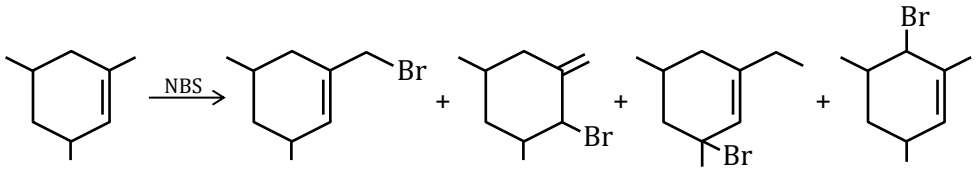


(1) (2) (2)

(cis + trans) (cis + trans)

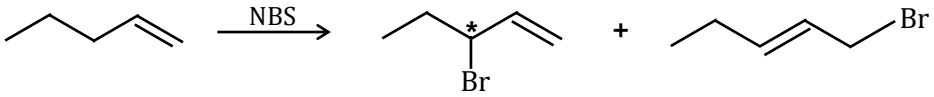
So total 5 Products

9. Ans. (4)



10. Ans. (4)

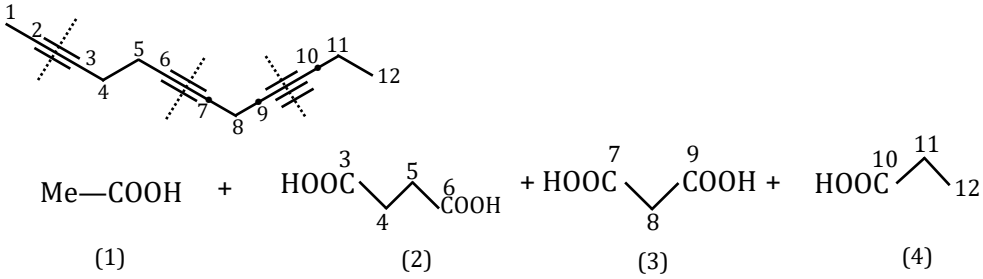
The products formed are :



(2) (2) (cis + Trans)

So total 4 Products

11. Ans. (4)



(1) (2) (3) (4)

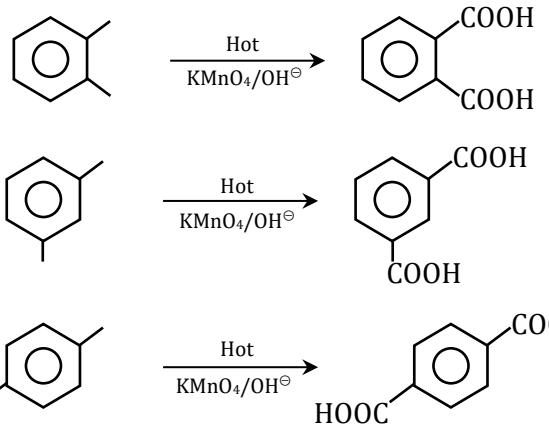
12. Ans. (2)

$Mg_2C_3 + H_2O \longrightarrow Mg(OH)_2 + CH_3C \equiv CH$

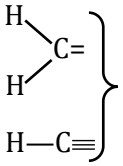
DOU = number of π-bond + number of ring.

= 2 + 0 = 2

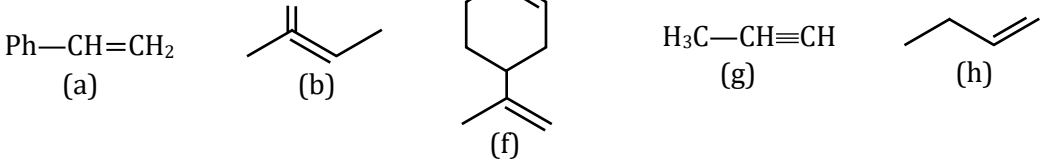
13. Ans. (3)



14. Ans. (5)

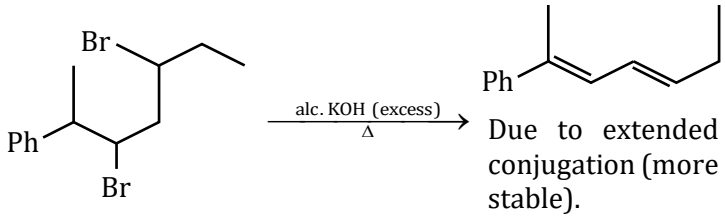


On oxidative ozonolysis gives CO_2



EXERCISE - JEE (Main) PYQ

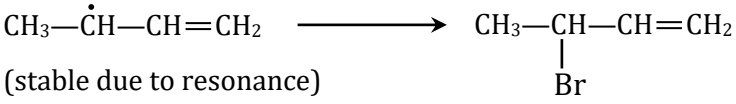
1. Ans. (3)



Due to extended conjugation (more stable).

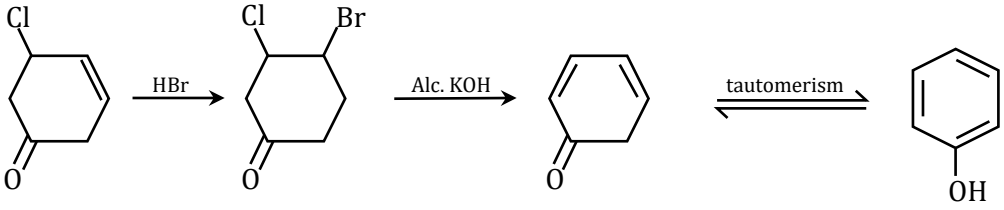
2. Ans. (2)

γ – hydrogen can form most stable free radical.

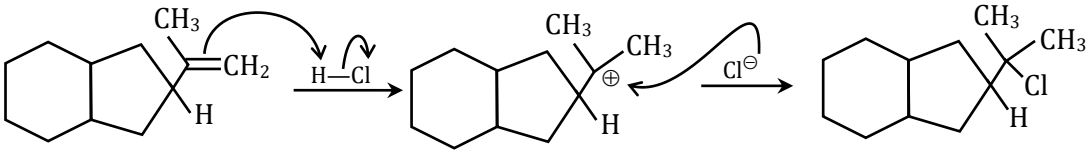


(stable due to resonance)

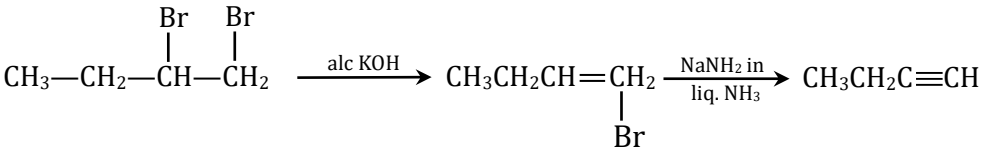
3. Ans. (1)



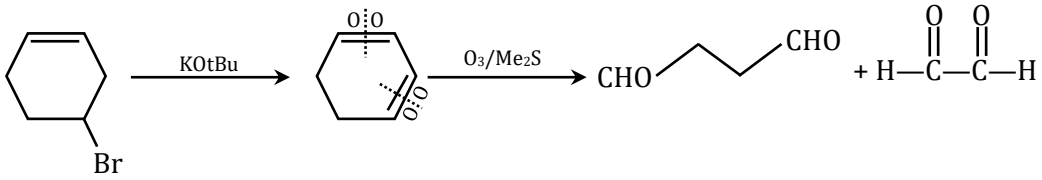
4. Ans. (1)



5. Ans. (1)

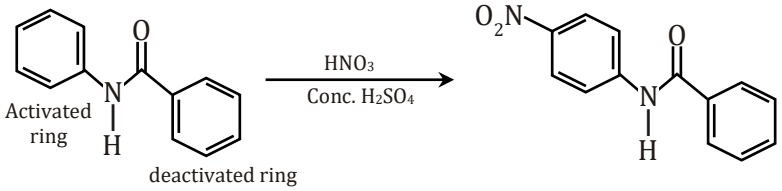


6. Ans. (2)

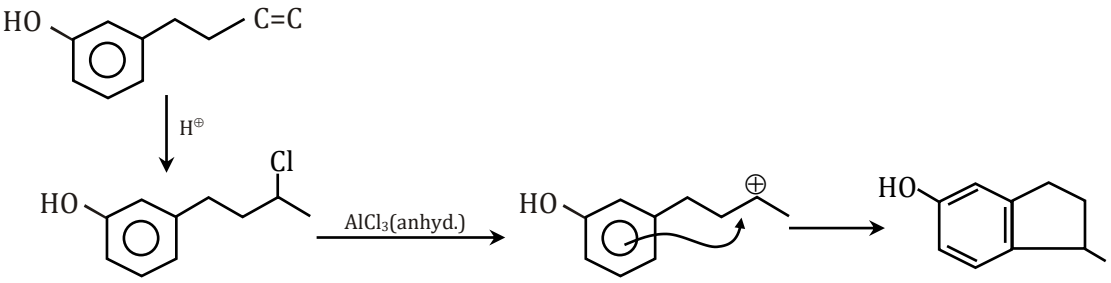


7. Ans. (3)

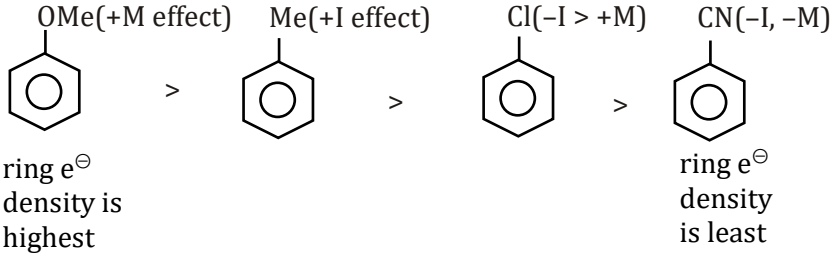
Electrophile $\rightarrow \overset{\oplus}{N}O_2$



8. Ans. (2)

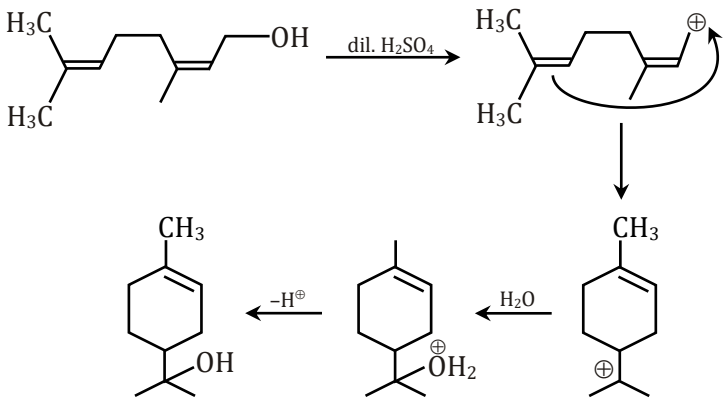


9. Ans. (3)

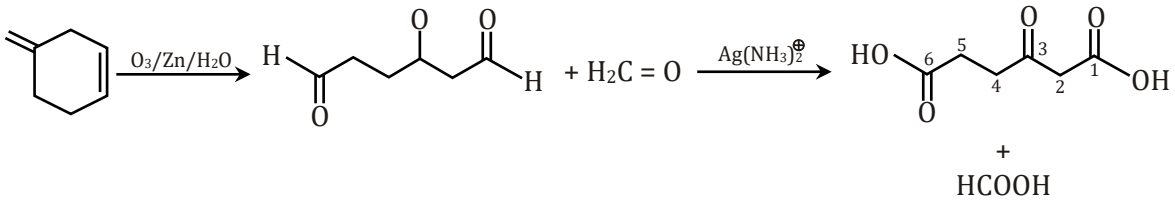


(More is the $e^{\ominus}$ density at ring faster will be the aromatic electrophilic substitution)

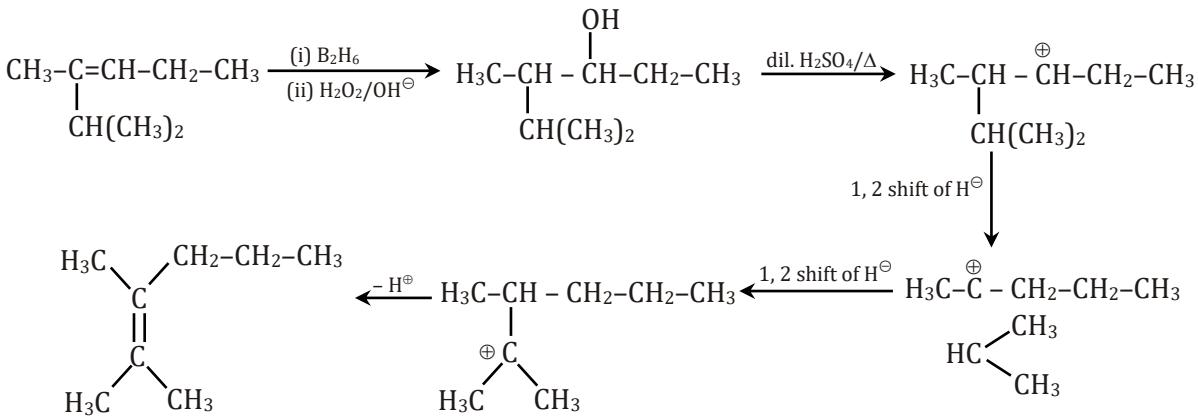
10. Ans. (2)



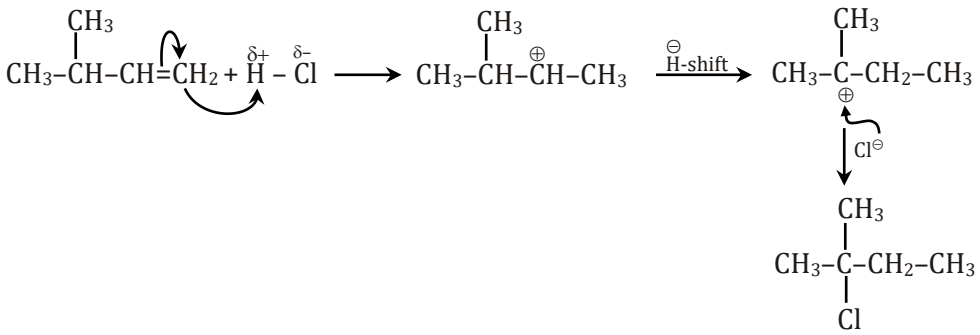
11. Ans. (1)



12. Ans. (1)

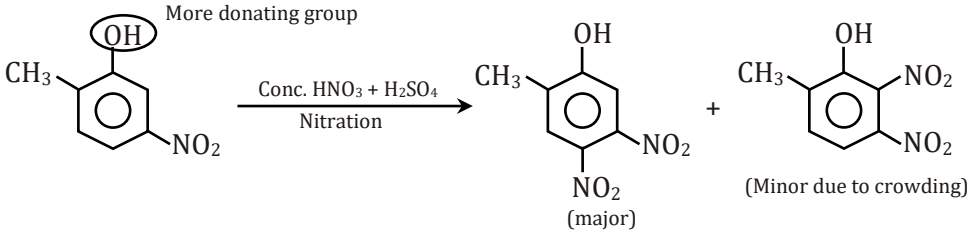


13. Ans. (1)

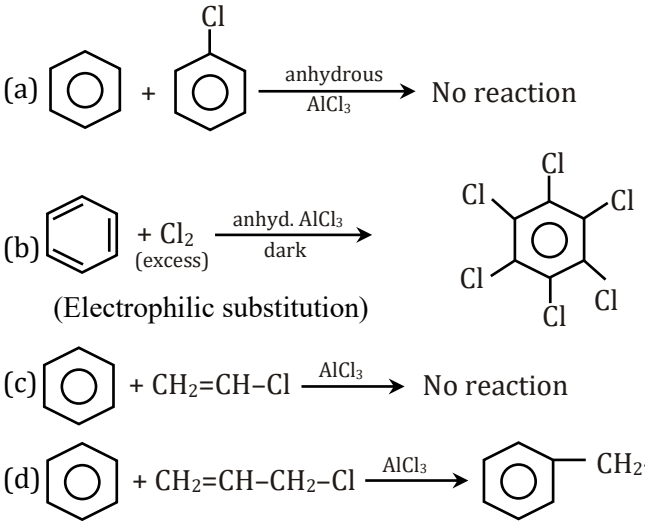


(No chiral centre, so no racemisation possible)

14. Ans. (3)

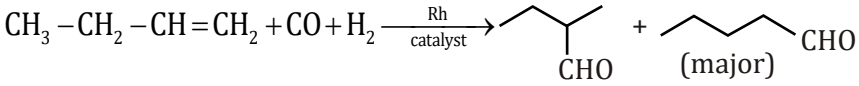


15. Ans. (2)

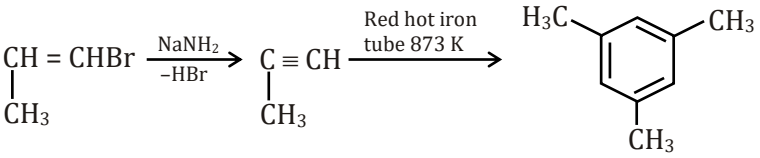


16. Ans. (3)

OXO PROCESS (Hydroformylation) :



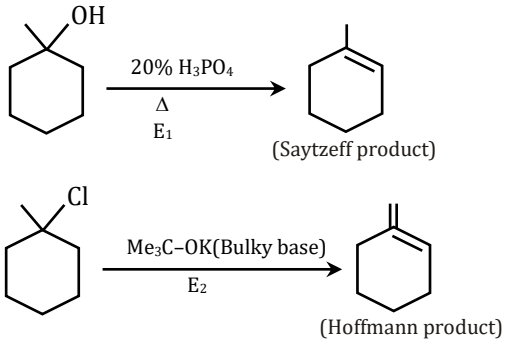
17. Ans. (4)



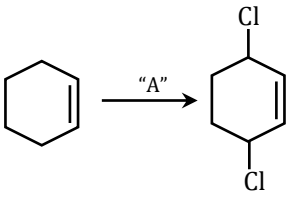
18. Ans. (4)

Partially deactivated palladised charcoal (H_2/pd-$CaCO_3$) is lindlar catalyst.

19. Ans. (3)

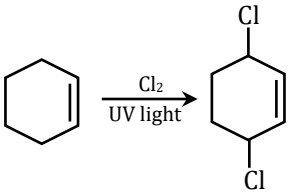


20. Ans. (3)

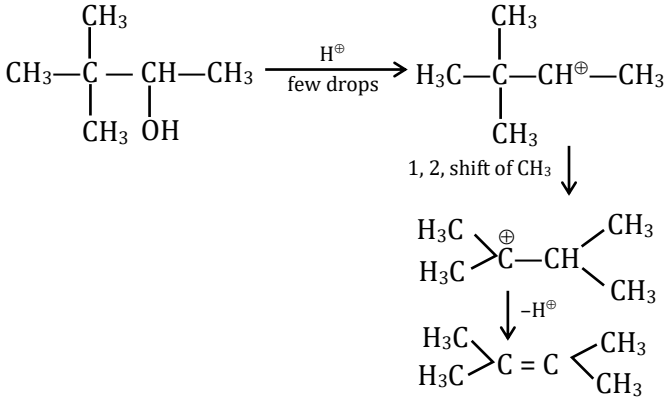


For substitution at allylic position in the given compound, the reagent used is Cl_2/uv light.

The reaction is free radical halogenation.



21. Ans. (2)

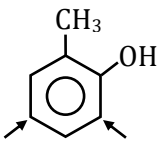


22. Ans. (1)

23. Ans. (3)

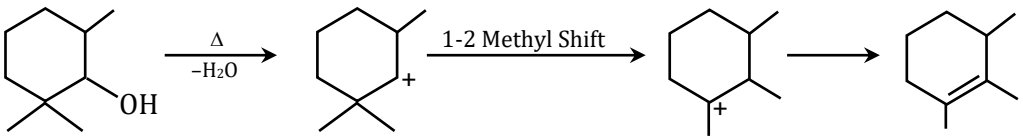
Electrophile will attack at ortho and para position with respect to better electron releasing group (ERG)

ERG : – OH > – CH_3



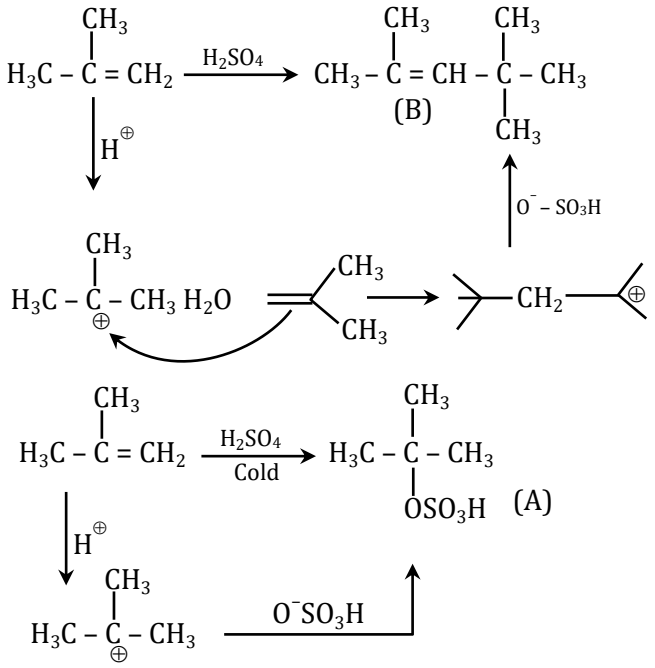
Para position with respect to – OH (+R) group and it will be meta position with respect to – CH_3 group.

24. Ans. (1)



Thermodynamically controlled product

25. Ans. (1)



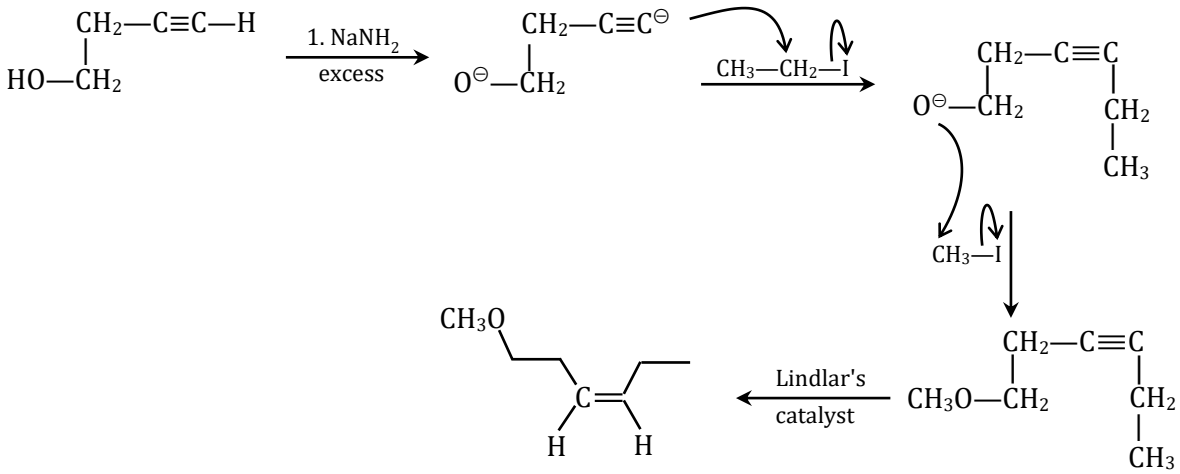
EXERCISE - JEE (Advanced) PYQ

1. Ans. (B)

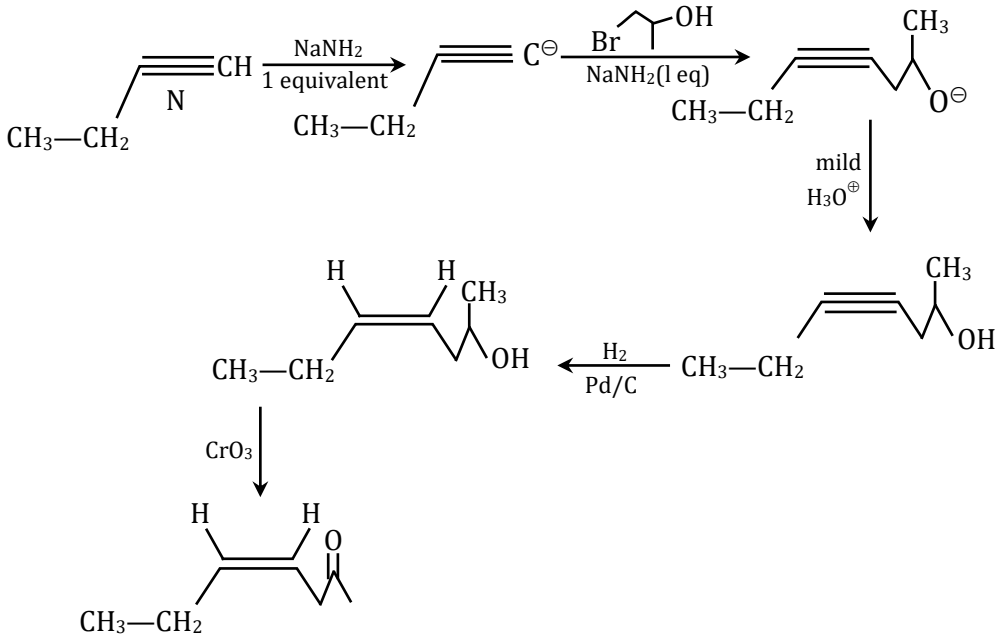
The correct order of their boiling point is III>II>I

More the branching in an alkane, lesser will be the surface area, hence lesser will be the boiling point.

2. Ans. (A)



3. Ans. (C)

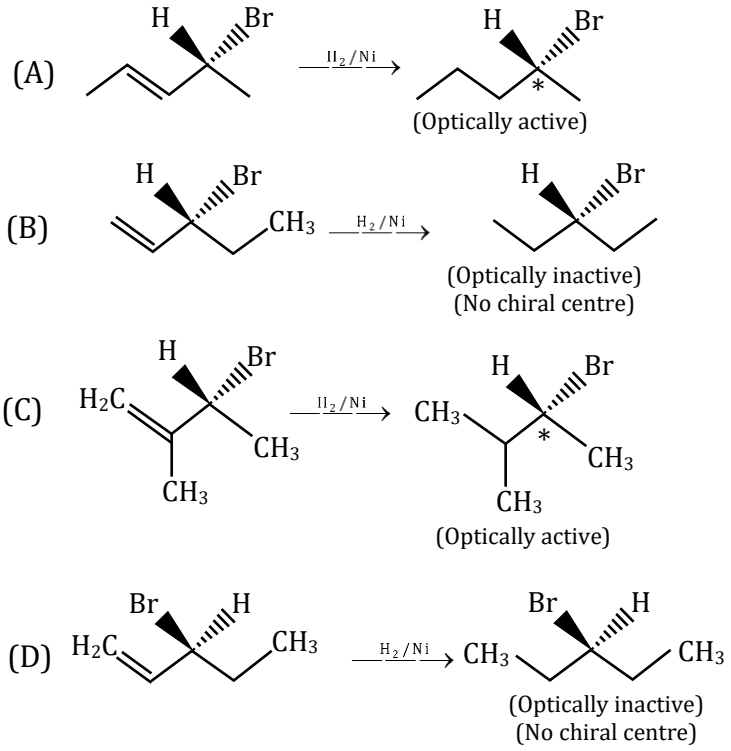


Iodoform test (+)

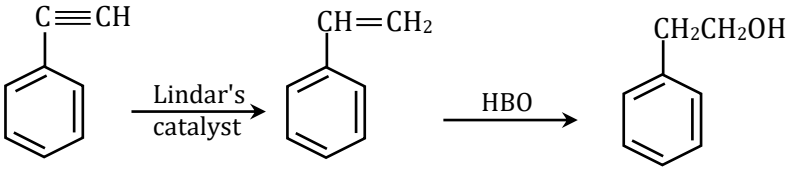
Thus, X and Y are functional isomers of each other and Y gives iodoform test due to the presence of CH_3CO group as Indicated.

Hence, correct choice is (c).

4. Ans. (BD)

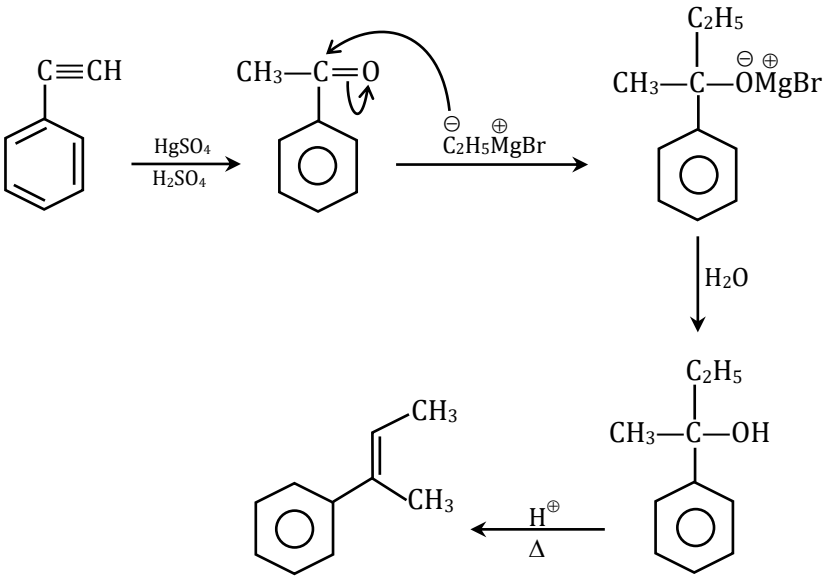


5. Ans. (C)

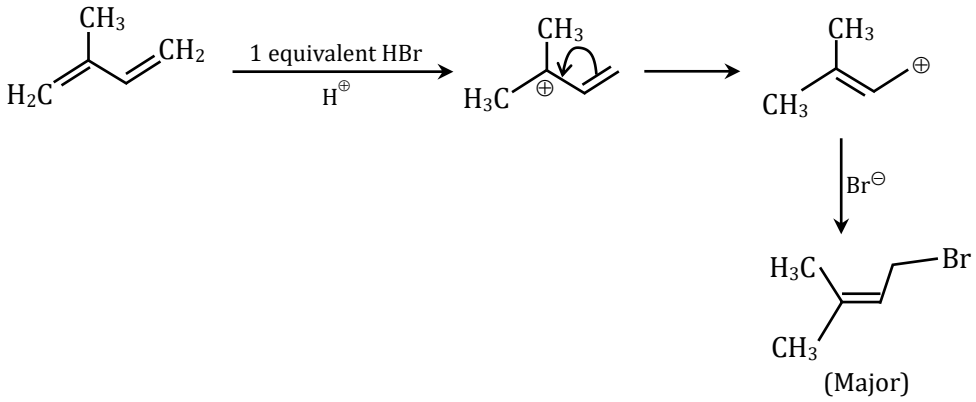


Anti Markovnikov rule

6. Ans. (D)

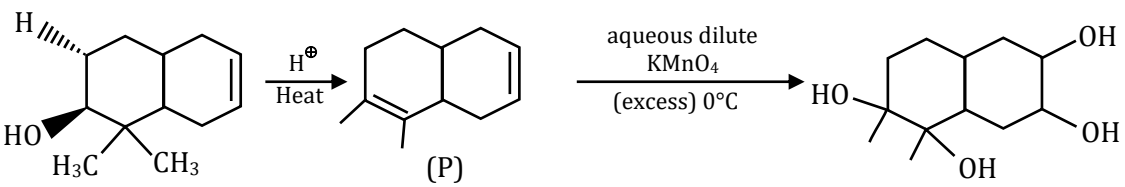


7. Ans. (D)



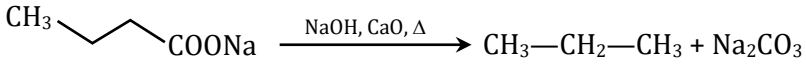
(Major)

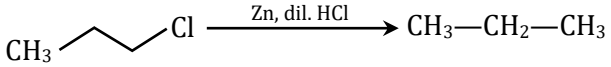
8. Ans. (4)



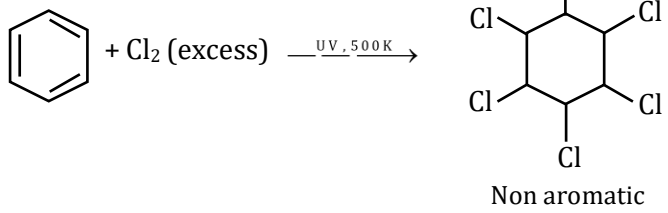
(P)

9. Ans. (B,C)

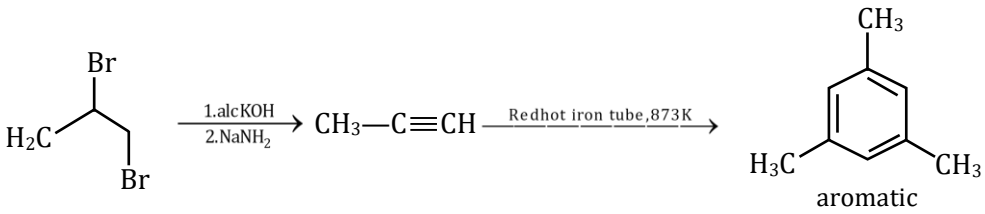
(B) 

(C) 

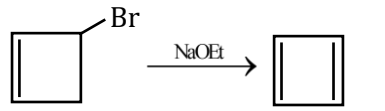
10. Ans. (B,D)

(A) 

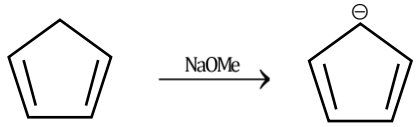
Non aromatic

(B) 

aromatic

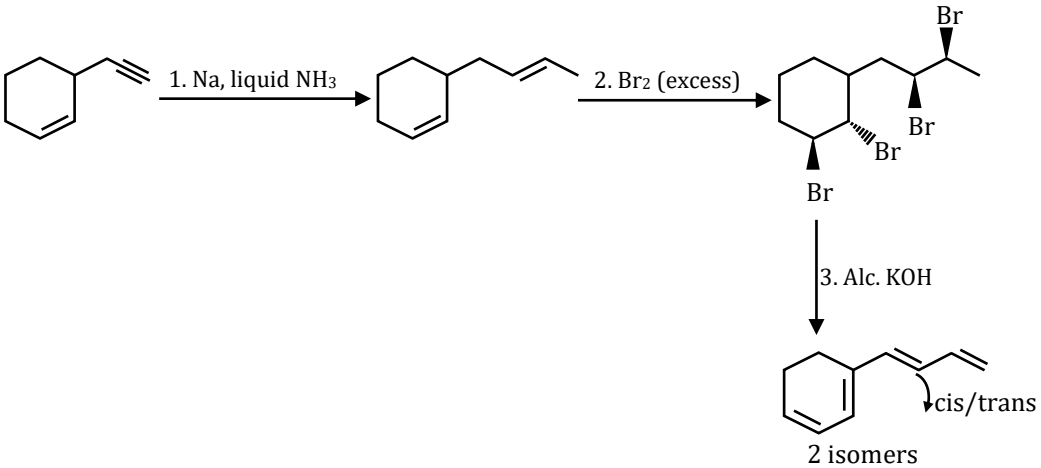
(C) 

Anti-aromatic

(D) 

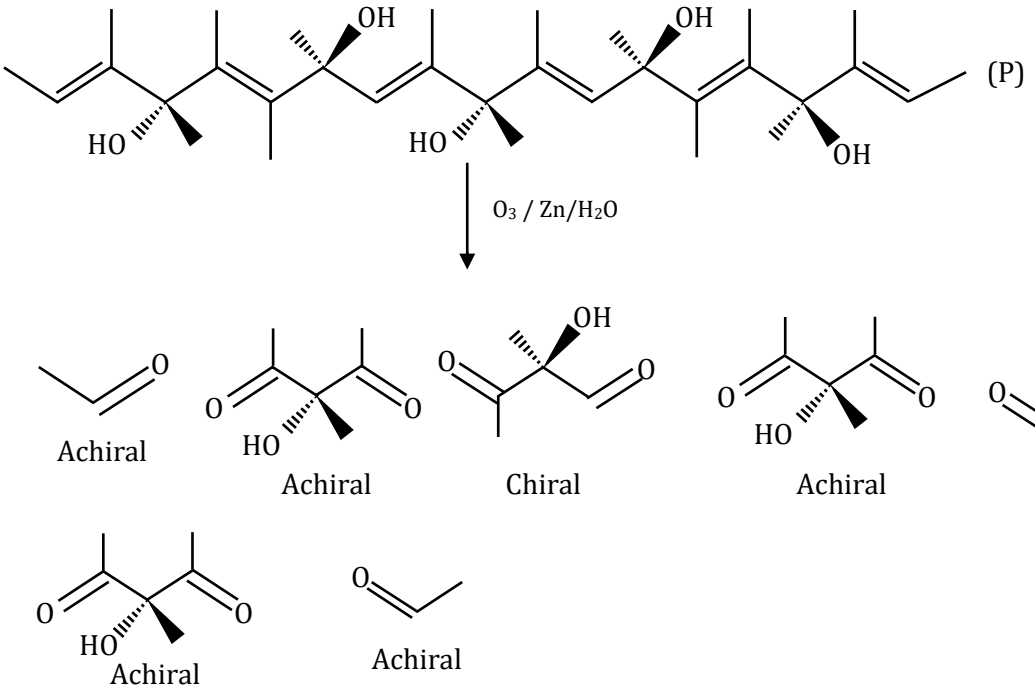
Aromatic

11. Ans. (2)



2 isomers

12. Ans. (2)

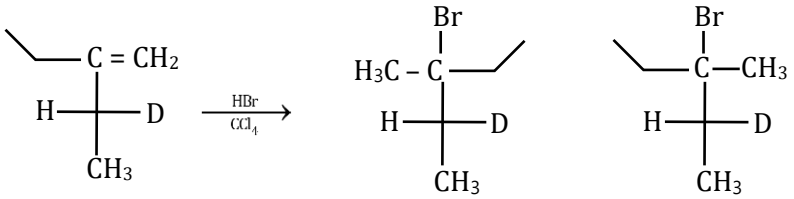


JEE (Main) Practice Paper

SECTION–A

1. Ans. (3)

The reaction proceeds via carbocation intermediate which is planar, so $Br^{\ominus}$ has two sides for attack. The products formed are:



Mixture of diastereomers

2. Ans. (2)

The intermediate formed during the addition of HCl to propene in the presence of peroxide is $CH_3\overset{\oplus}{C}HCH_3$. Secondary carbocation is formed as it is more stable than primary carbocation.

3. Ans. (1)

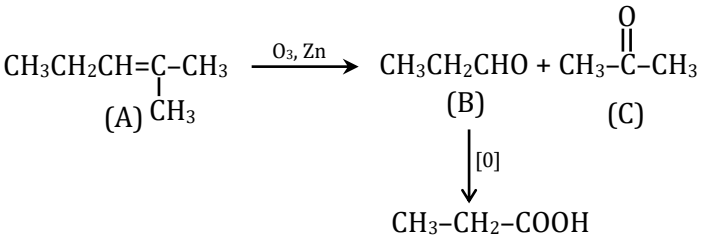
$CH_3-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3 + CH_3-CH_2-CH_2-CH_2-Br$

exist in 2 enantiomers A and B (Major product) — (minor product) C

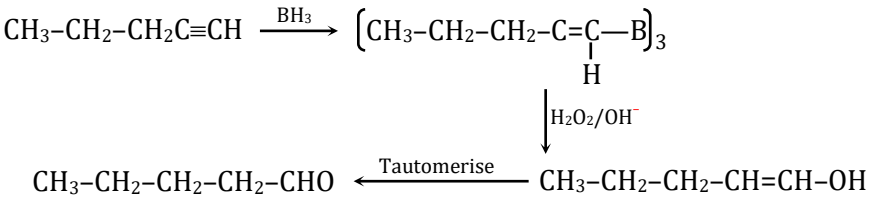
4. Ans. (3)

$$CH_3C\equiv CH \xrightarrow[aq.H_2SO_4]{HgSO_4} CH_3-\underset{\underset{OH}{|}}{C}=CH_2 \xrightarrow{\text{tautomerisation}} CH_3-\overset{\overset{O}{||}}{C}-CH_3$$

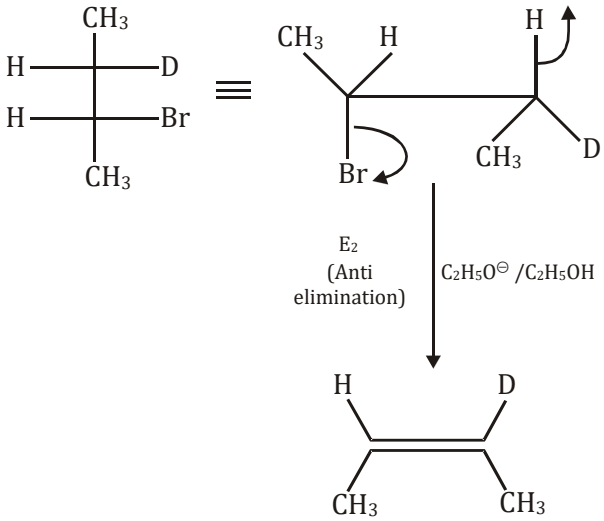
5. Ans. (2)



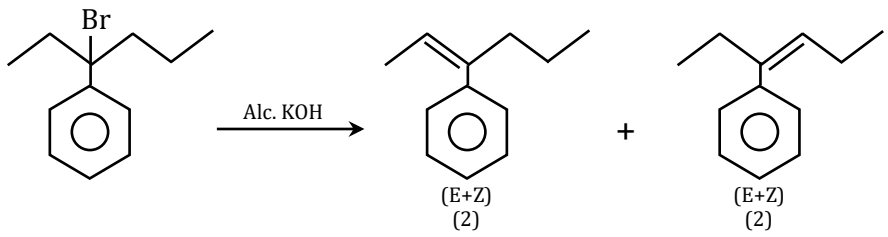
6. Ans. (4)



7. Ans. (3)

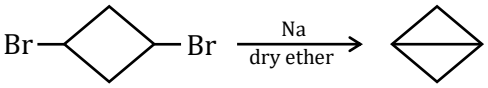


8. Ans. (2)

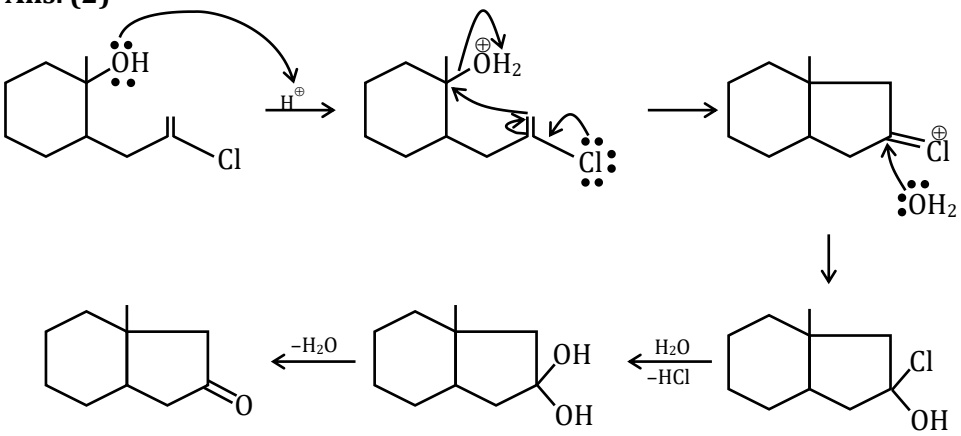


Total = 2 + 2 = 4

9. Ans. (2)

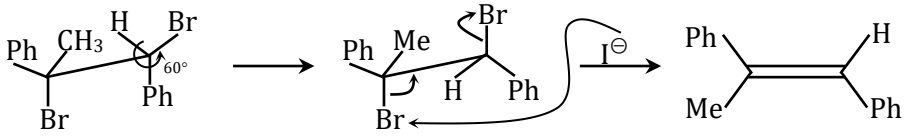


10. **Ans. (2)**



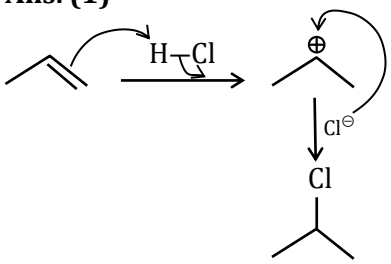
11. **Ans. (3)**

Here NaI/Acetone will do E_2–Elimination



Alkene behave as nucleophile become it is e^- rich species.

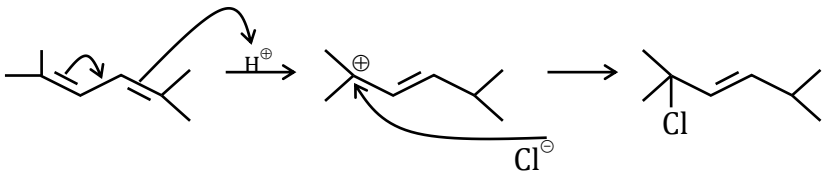
12. **Ans. (1)**



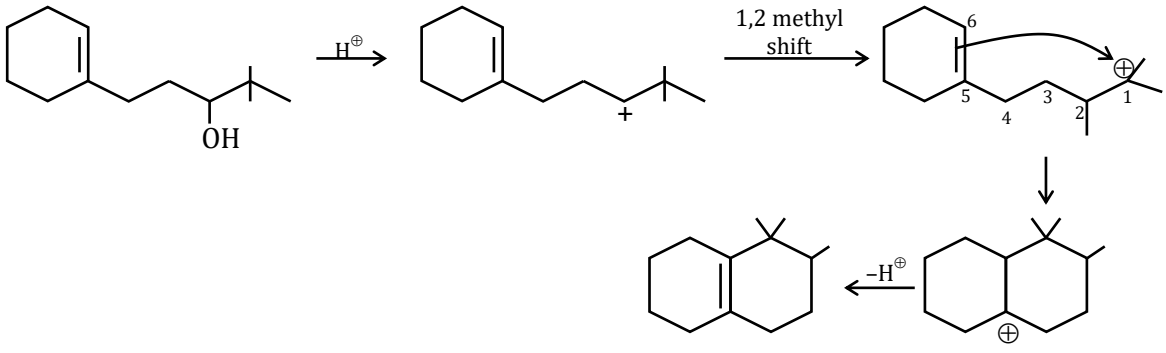
13. **Ans. (4)**

$$O_2N-CH=CH_2 \xrightarrow{H^{\oplus}} O_2NCH_2\overset{\oplus}{C}H_2 \xrightarrow{Br^{\ominus}} O_2NCH_2\underset{Br}{C}H_2$$

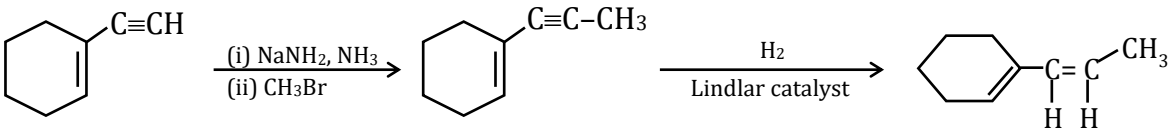
14. **Ans. (1)**



15. **Ans. (2)**

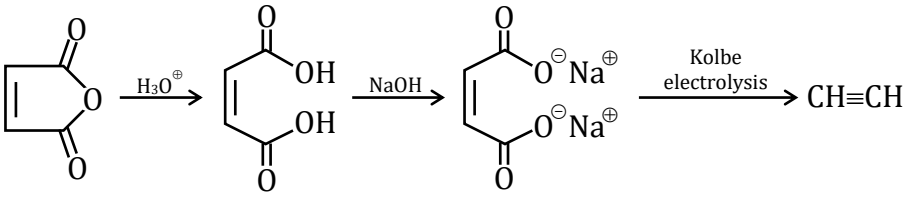


16. **Ans. (3)**



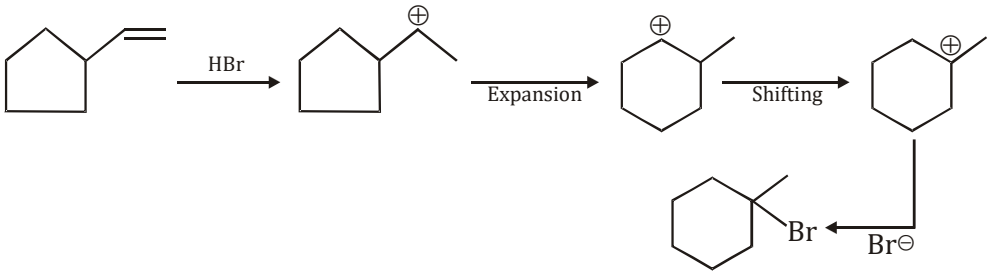
cis-Alkene

17. **Ans. (3)**

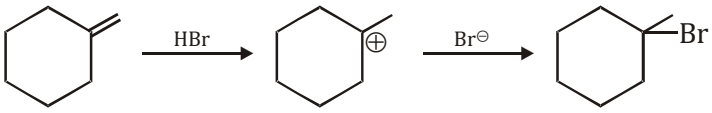


18. **Ans. (4)**

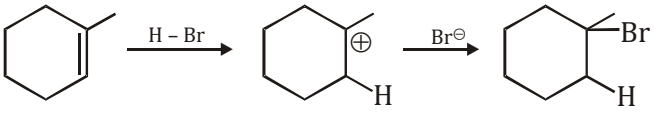
(1)



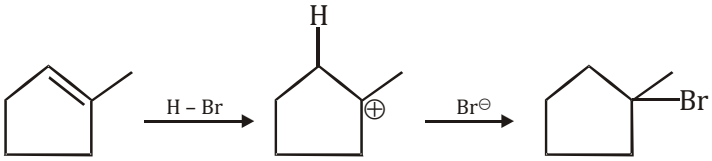
(2)



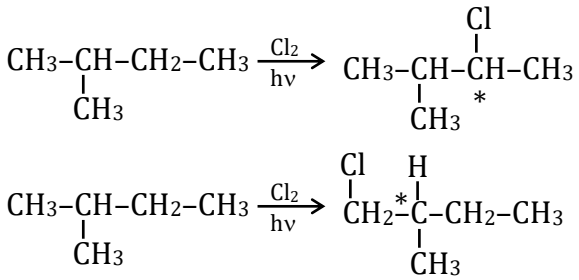
(3)



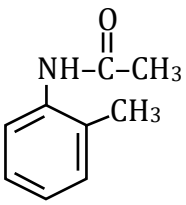
(4)



19. **Ans. (2)**



20. **Ans. (2)**



B ⟶ More $e^{\ominus}$ rich less steric hindrance

SECTION-B

1. Ans. (3)

(a), (d), (e)

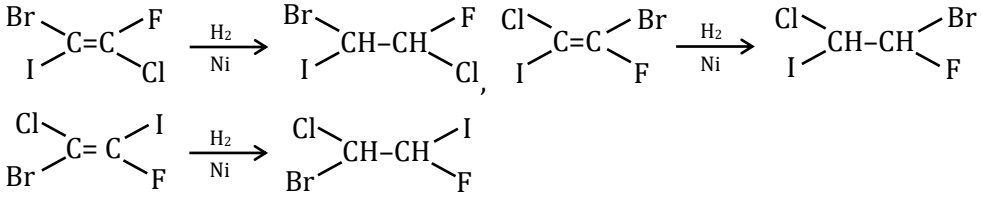
Compounds which contains $e^{\ominus}$ withdrawing group i.e., deactivated ring do not undergo rearrangement reaction. Compounds (b) and (c) contain $-NO_2$ and $(C \equiv N)$ groups respectively will not undergo rearrangement reaction.

2. Ans. (312)

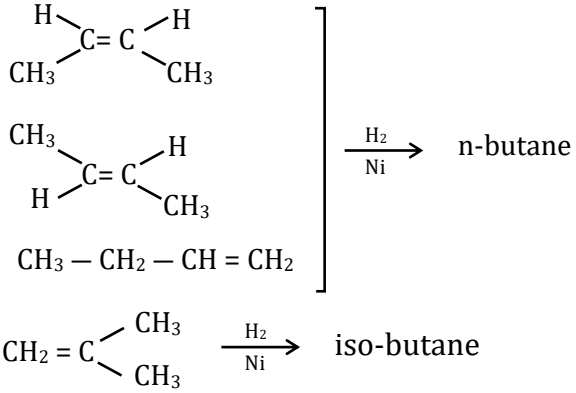
A = B = C = D =  → Molecular mass = 78

$\therefore$ A + B + C + D = 78 × 4 = 312

3. Ans. (5)

(1) 

$\therefore$ A = 3

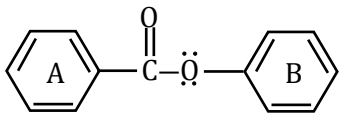
(2) 

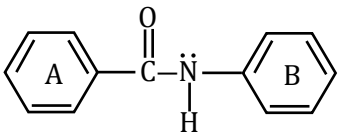
$CH_3 - CH_2 - CH = CH_2$

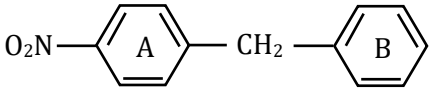
$\therefore$ B = 2

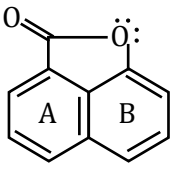
A + B = 3 + 2 = 5

4. Ans. (4)

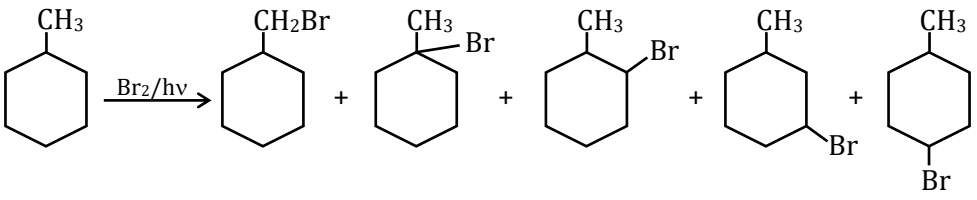
(ii) 

(iii) 

(v) 

(vi) 

5. Ans. (5)



6. **Ans. (90)**

Percentage 3° R-Br = $\frac{1\times1600}{1\times1600+15\times1+2\times84}\times100 = 89.8\% \simeq 90\%$

7. **Ans. (3)**

$CH_3-CH_2-CH_3 \xrightarrow[h\nu]{Cl_2} CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 + CH_3-CH_2-CH_2-Cl$

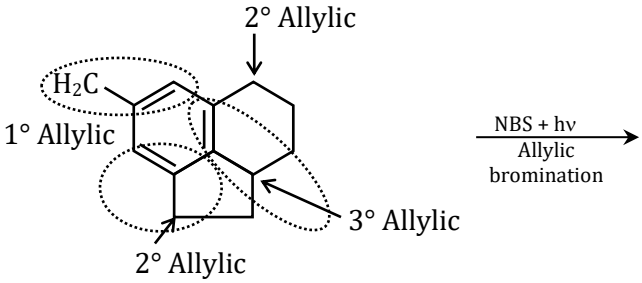
2–(2°-carbon) 6–(1°-carbon)

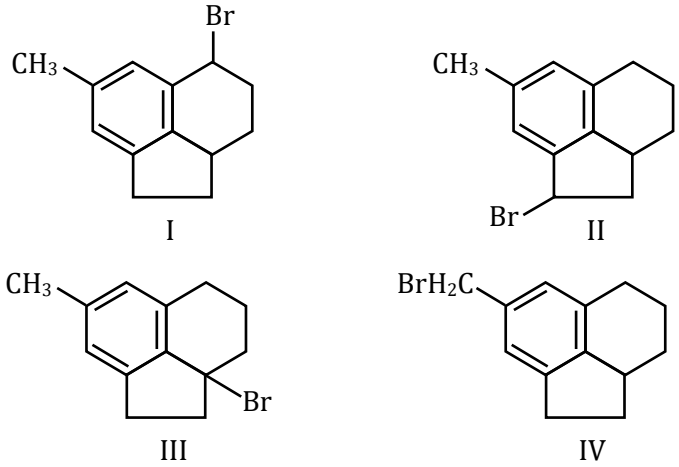
Ratio = $\frac{6}{2}=\frac{3}{1}=3$

8. **Ans. (4)**

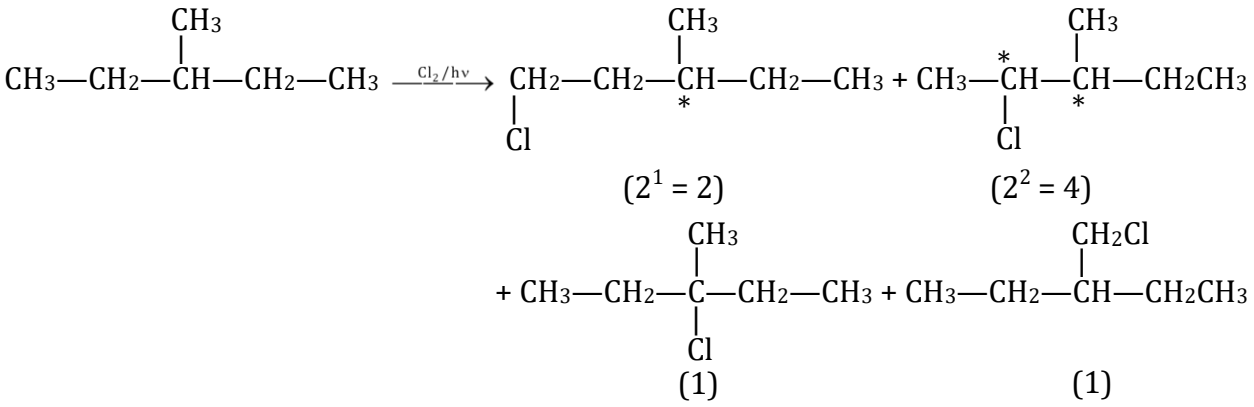
Alkaline $KMnO_4$ reacts with double, triple bond, alcohols and aldehydes and colour of $KMnO_4$ is discharged

9. **Ans. (4)**





10. **Ans. (8)**



Total = 8

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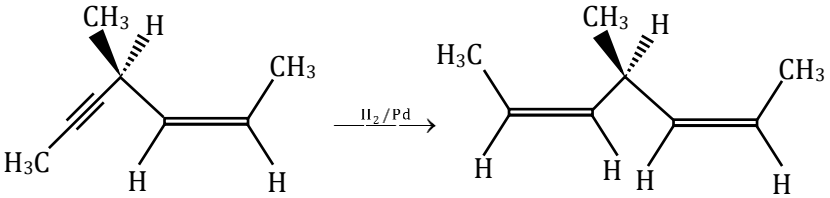
1. Ans. (C)

Ease of catalytic hydrogenation depends upon the size of groups present at the doubly bonded carbon. Larger the size of groups, difficult the hydrogenation. Therefore, in the given situation, disubstituted reacts at faster rate than tri and tetra substituted alkenes. Among disubstituted, least stable alkene gives faster reaction.

cis < geminal < trans.

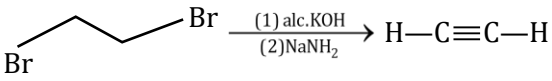
2. Ans. (B)

Hydrogenation with poisoned palladium brings about cis hydrogenation of alkyne and does not affect double bonds :

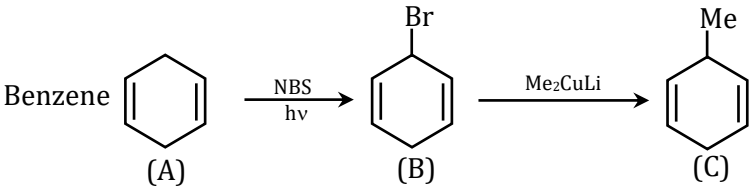


meso-compound
(optically inactive)

3. Ans. (B)



4. Ans. (B)



5. Ans. (B)

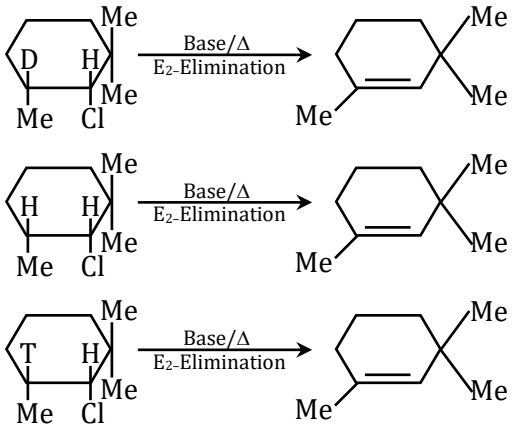
Bromine is more selective; therefore, it will form 3° halide if there is presence of 3° H-atom.

Hence B, D, E, form 3° halide, as major and A, C, F form 2° halide as major.

6. Ans. (B)

Since kinetic isotopic effect is observed in E_2–Elimination

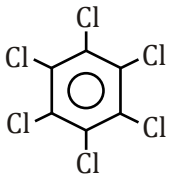
So $K_H > K_D > K_T$

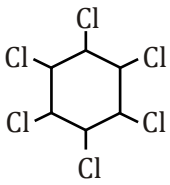


So, rate of E_2–Elimination will be as

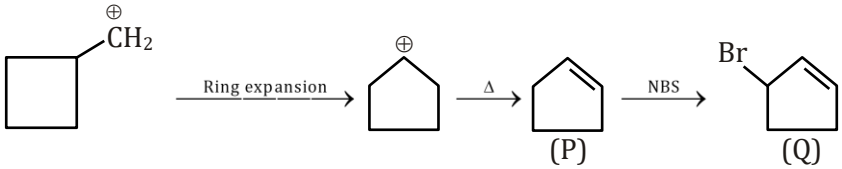
(ii) > (i) > (iii)

7. **Ans. (C)**

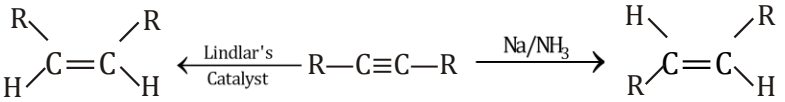
Product A will be  → Hexachlorobenzene; → Aromatic

Product B will be  → 1,2,3,4,5,6-Hexachlorocyclohexane; → Not Aromatic

8. **Ans. (C)**

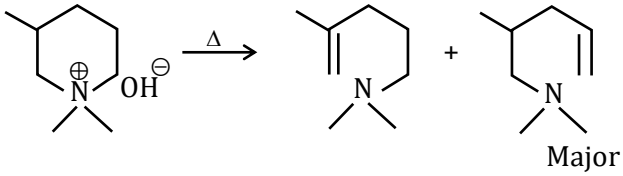


9. **Ans. (A)**



cis Product (B) Trans Product (A)

10. **Ans. (A,C,D)**



It is pyrolysis of quaternary Ammonium hydroxide follows E_2 Mechanism with character of E_{1CB} so Hoffmann's Alkene is major product

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

$CH_3—CH_2—COO^{\ominus}K^{\oplus} \xrightarrow{\text{Electrolysis}} \underset{(I)}{CH_3—CH_2—COO^{\bullet}} \longrightarrow \underset{(II)}{CH_3—CH_2^{\bullet}}$

(I) + (II) $\longrightarrow CH_3—CH_2—COOCH_2CH_3$

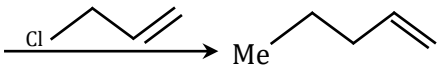
(II) + (II) $\longrightarrow CH_3—CH_2—CH_2—CH_3$ (n-butane)

$2CH_3—\dot{C}H_2 \xrightarrow{\text{disprop.}} CH_2=CH_2 + CH_3—CH_3$

12. **Ans. (A)**

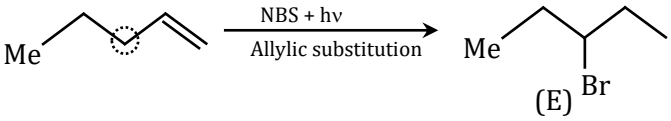
$\underset{(A)}{CH_3-CH_3} \xrightarrow{Cl_2+h\nu} \underset{(B)}{CH_3-CH_2-Cl} \xrightarrow[2.\ CuI]{1.\ Li} \underset{(C)}{(C_2H_5)_2\,CuLi}$

13. **Ans. (B)**

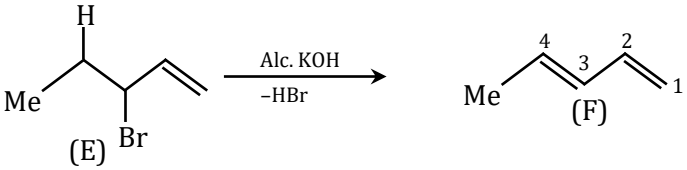
$\underset{(C)}{(C_2H_5)_2\,CuLi}$ 

(D)

14. Ans. (B)



15. Ans. (B)



16. Ans. (A)

- Reaction (a) is isomerisation reaction.
- Reaction (b) is hydroxylation of 3° H atoms, which is carried out by alkaline $KMnO_4$.
  So, the answer is (p).
- Reaction (c) is conversion of carbonyl group to ($-CH_2$) group, which is carried out by Clemmenson or Wolff-Kishner or HI + P reactions.
  So, the answer is (q, s, and u).
- Reaction (d) is reduction of RX to RH, which is carried out by HI + Red P

17. Ans. (175)

$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

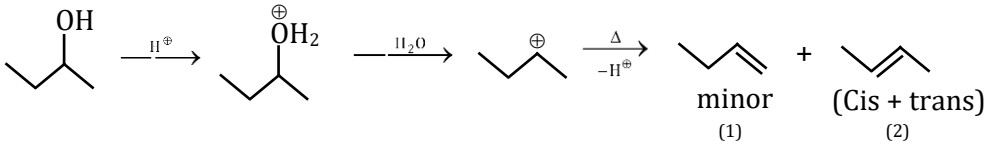
For 2 lit. of $C_2H_6 \longrightarrow$ 7 lit. O_2 is required.

$\therefore$ for 10 lit. of $C_2H_6 \longrightarrow \frac{7}{2} \times 10 = 35$ lit. O_2 is required.

$\therefore$ volume of air = 35 × 5 = 175 lit.

18. Ans. (3)

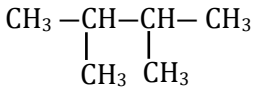
Three structures of X are possible :

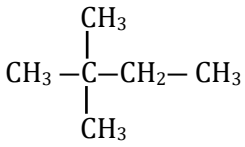


$\therefore$ Total product = 3.

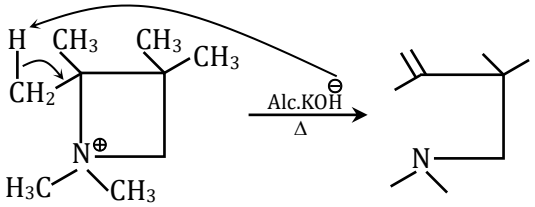
19. Ans. (5)

1. $CH_3-CH_2-CH_2-CH_2-CH_3$
2. $CH_3-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$
3. $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_3$

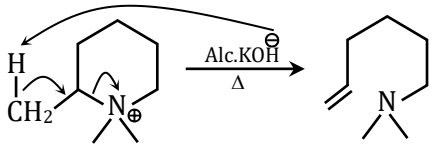
4. 

5. 

20. Ans. (2)

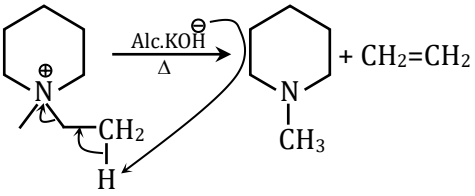
(a) 

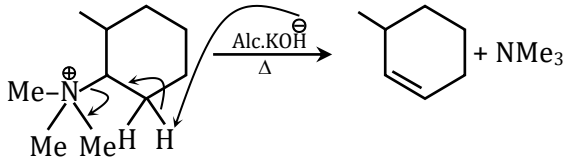
Follows E_2–Elimination and major product is Hoffmann here

(b) 

E_2–Elimination

Hoffmann product

(c) 

(d) 

Basically, in pyrolysis tetra alkyl ammonium ion less substituted β–hydrogen abstracted by base via E_2–like Elimination.

So (a),(b) follows.