CHAPTER

3

Hydrocarbons

Question Bank

LEVEL 1

1. When the trans-2-pentene is treated with Br_2 in the presence of CCl_4, then the number of stereoisomers formed is

(a) 1 (b) 2 (c) 3 (d) 4

2. Which one of the following compounds will give Saytzeff product in E_2 reaction?

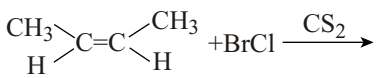
(a) $CH_3–CH_2–\underset{\displaystyle Br}{\underset{|}{CH}}–CH_3$ (b) $CH_3–CH_2–\underset{\displaystyle F}{\underset{|}{CH}}–CH_3$

(c) $CH_3-CH_2-CH_2-\overset{\oplus}{N}(CH_3)_3\,\overset{\ominus}{O}H$ (d) $CH_3–CH_2–\underset{\displaystyle OCOCH_3}{\underset{|}{CH}}–CH_3$

3. Which compound is most reactive for E_{1CB} reaction?

(a) $CH_3–CH_2F$ (b)  (c)  (d) $C_6H_5–CH_2–CH_2F$

4. In the given reaction

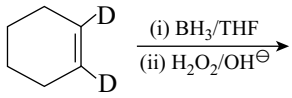


The correct option about the product is

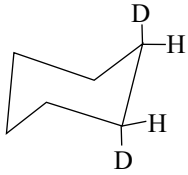
(a) (+)-2-bromo-3-chlorobutane (b) (±)-threo-2-bromo-3-chlorobutane

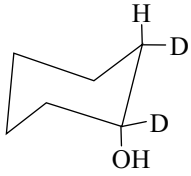
(c) (+)-threo-2-bromo-3-chlorobutane (d) (–)-threo-2-bromo-3-chlorobutane

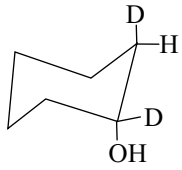
5. In the given reaction

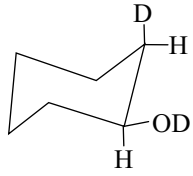


the product is

(a) 

(b) 

(c) 

(d) 

6. o-xylene on ozonolysis may give

(a) $\begin{matrix}CHO\\|\\CHO\end{matrix}$ and $CH_3-\overset{O}{\overset{\|}{C}}-CHO_3$

(b) $\begin{matrix}CH_3-C=O\\|\\CH_3-C=O\end{matrix}$ and $CH_3-\overset{O}{\overset{\|}{C}}-CHO$

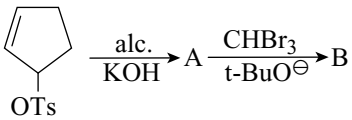
(c) $\begin{matrix}CH_3-C=O\\|\\CH_3-C=O\end{matrix}$ and $\begin{matrix}CHO\\|\\CHO\end{matrix}$

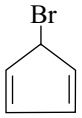
(d) $\begin{matrix}CH_3-C=O\\|\\CH_3-C=O,\end{matrix}$ $CH_3-\overset{O}{\overset{\|}{C}}-CHO$ and $\begin{matrix}CHO\\|\\CHO\end{matrix}$

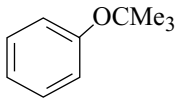
7. A hydrocarbon (C_4H_8) on reaction with m-chloro perbenzoic acid (MCPBA) gives (X). (X) on reaction with KOH (aq.) gives (Y), which on treatment with conc. H_2SO_4 forms 2-methyl propanal. The hydrocarbon is

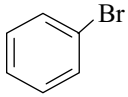
(a) $\begin{matrix}CH_2=C-CH_3\\|\\CH_3\end{matrix}$ (b) $CH_3-CH=CH-CH_3$ (c) $CH_3CH_2CH=CH_2$ (d) 

8. The final product of the following sequence is



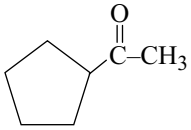
(a) 

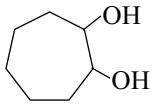
(b) 

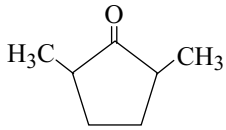
(c) 

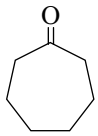
(d) 

9. Major product of reaction between cycloheptyne and H_2O, $H_2SO_4/HgSO_4$ is

(a) 

(b) 

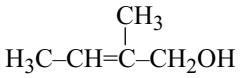
(c) 

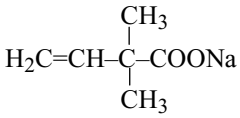
(d) 

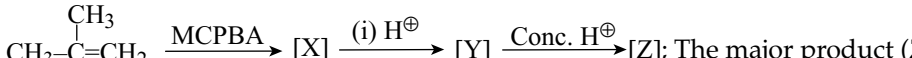
10. $\begin{matrix}CH_3\\|\\H_2C=CH-C-COOH\\|\\CH_3\end{matrix}$ $\xrightarrow[CaO/\Delta]{NaOH}$ X; X will be

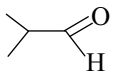
(a) $\begin{matrix}CH_3\\|\\H_3C-CH=C-CH_3\end{matrix}$

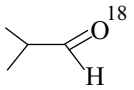
(b) $\begin{matrix}CH_3\\|\\H_2C=CH-C-CH_3\\|\\H\end{matrix}$

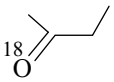
(c) 

(d) 

11.  ; The major product (Z) can be

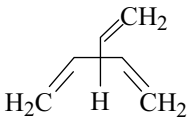
(a) 

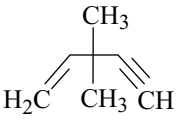
(b) 

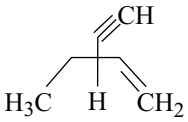
(c) 

(d) 

12. An optically active organic compound has the molecular formula C_7H_{10} (A). On reaction with H_2 + Pt it forms an optically inactive compound (B). Then, compound (A) will be

(a) 

(b) 

(c) 

(d) None of these

13. Identify end products A, B and C of the following

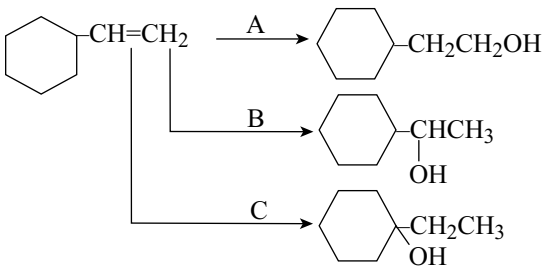
$CH_3CH{=}CH_2 \xrightarrow[(ii)\ H_2O]{(i)\ D^{\oplus}} A$

$CH_3CH{=}CH_2 \xrightarrow[(ii)\ D_2O]{(i)\ H^{\oplus}} B$

$CH_3CH{=}CH_2 \xrightarrow[(ii)\ D_2O]{(i)\ D^{\oplus}} C$

(a) $CH_3\underset{\underset{OH}{|}}{C}HCH_3$ in all case (b) $CH_3CH(OH)CH_2D$, $CH_3CH(OD)CH_3$, $CH_3CH(OD)CH_2D$

(c) $CH_3\underset{\underset{OD}{|}}{C}HCH_3$ in all cases (d) $CH_3\underset{\underset{OD}{|}}{C}HCH_2D$ in all cases

14. 

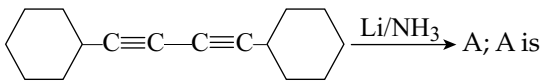
Schemes A, B and C are

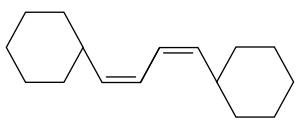
(a) simple acid catalysed hydration

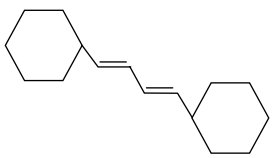
(b) hydroboronation, mercuration-demercuration, acid-catalysed hydration

(c) acid-catalysed hydration, hydroboronation, mercuration-demercuration

(d) mercuration-demercuration, acid-catalysed hydration, hydroboronation

15.  A; A is

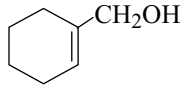
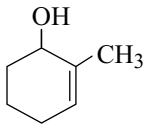
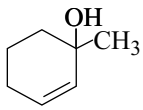
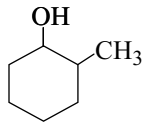
(a) 

(b) 

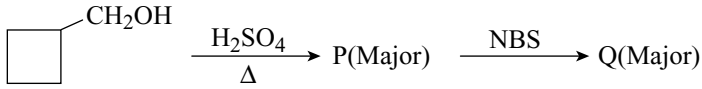
(c) both are correct

(d) none is correct

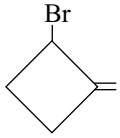
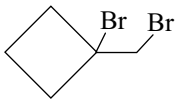
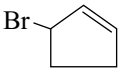
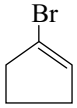
16. Rate of dehydration when given compounds are treated with conc. H_2SO_4 is

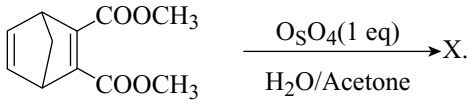
(P)  (Q)  (R)  (S) 

(a) P > Q > R > S (b) Q > P > R > S (c) R > Q > P > S (d) R > Q > S > P

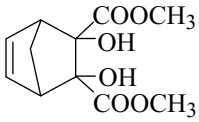
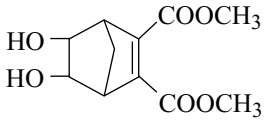
17. 

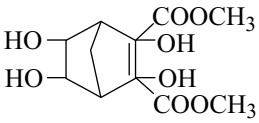
The structure of Q is

(a)  (b)  (c)  (d) 

18. 

Identify "X":

(a)  (b) 

(c)  (d) reaction will not occur

19. 1-Penten-4-yne reacts with bromine at –80°C to produce

(a) 4, 4, 5, 5-Tetrabromopentene (b) 1, 2-Dibromo-1, 4-pentadiene

(c) 1, 1, 2, 2, 4, 5-hexabromopentane (d) 4, 5-dibromopentyne

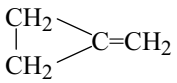
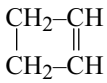
20. Which of the following reagents cannot be used to locate the position of triple bond in $CH_3–C\equiv C–CH_3$?

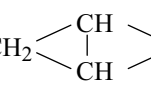
(a) Br_2 (b) O_3 (c) Cu_2^{2+} (d) $KMnO_4$

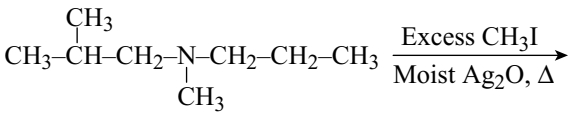
21. An organic compound of molecular formula C_4H_6, (A) forms a precipitate with ammonical silver nitrate and ammonical cuprous chloride. "A" has an isomer "B", one mole of which reacts with 1 mole of Br_2 to form 1, 4-dibromo-2-butene. Another isomer of A is "C", one mole of C reacts with only 1 mole of Br_2 to give vicinal dibromide. A, B and C are

(a) $CH_3–CH_2–C\equiv CH$ and $CH_2=CH–CH=CH_2$; 

(b) $CH_3–C\equiv C–CH_3$ and $CH_3–CH=C=CH_2$; $CH_3–C\equiv C–CH_3$

(c)  and  ; $CH_2=CH–CH=CH_2$

(d) $CH_3–C–C\equiv CH_3$ and  ; $CH_2=CH–CH=CH_2$

22. 

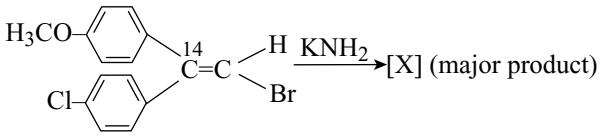
Product mixture $\xrightarrow{O_3/Zn\text{-}H_2O}$ Final product mixture

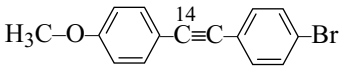
The final product mixture contains:

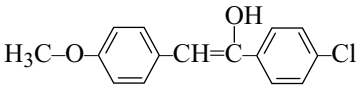
(a) $CH_3CHO + CH_3COCH_3$ (b) $CH_3CHO + CH_3CH_2CH_3 + HCHO$

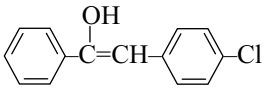
(c) $CH_3CHO + HCHO$ (d) $CH_3CHO + CH_3COCH_3 + HCHO$

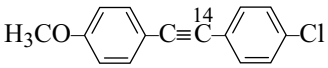
23. Choose the correct major product



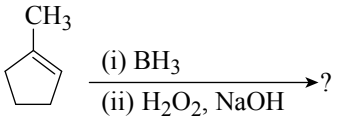
(a) 

(b) 

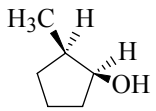
(c) 

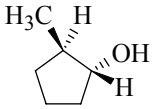
(d) 

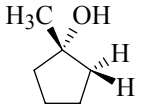
24. Supposed you carried out the hydroboration of 1-methylcyclopentene:

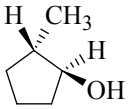


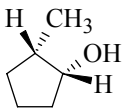
Choose the correct answer for the products formed in the above reaction.

(i) 

(ii) 

(iii) 

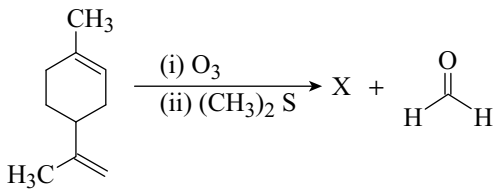
(iv) 

(v) 

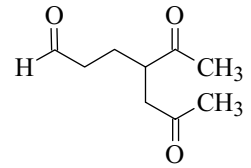
(a) An equal mixture of 1 and 5 (b) An equal mixture of 1 and 2

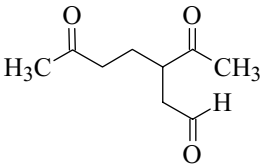
(c) An equal mixture of 2 and 4 (d) An equal mixture of 4 and 5

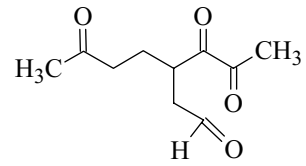
25. The ozonolysis of limonene (oil of lemons) give compound X plus formaldehyde. Choose the correct structure for X.

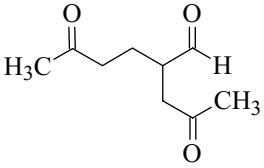


Limonene

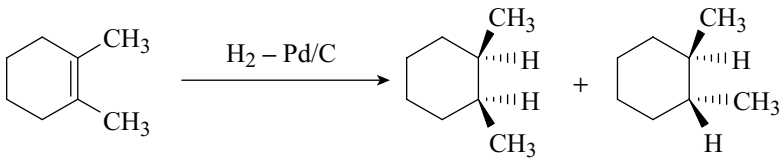
(a) 

(b) 

(c) 

(d) 

26. Choose the incorrect statement about the following catalytic hydrogenation.



major minor

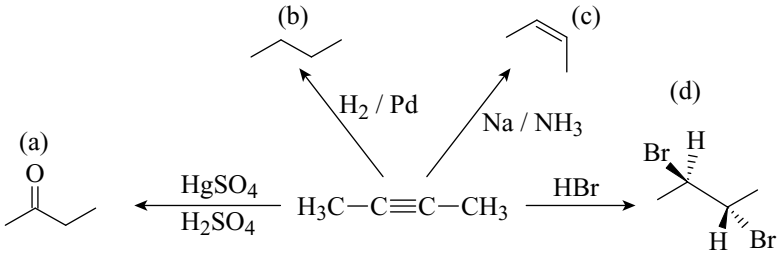
(a) The minor product occurs as the result of a catalyzed isomerization of the reactant.

(b) The minor trans isomer is actually present as a racemic mixture.

(c) The syn addition of hydrogen gives the cis isomer as the major product.

(d) The catalyst (Pd/C) speeds up the reaction by stabilizing the major product of the reaction.

27. Choose the incorrect reaction.

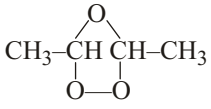


28. Product of the reaction $CH_3 - CH = CH - CH_3 \xrightarrow[-78°C]{O_3/CH_2Cl_2}$ will be

(a) CH_3–CHO

(b) CH_3–COOH

(c) $CH_3–\underset{\underset{OH}{|}}{CH}–\underset{\underset{OH}{|}}{CH}–CH_3$

(d) 

29. $H_2C(OH)–CH=CH_2 \xrightarrow[(ii)\ NaSO_3H]{(i)\ OsO_4}$ (A) $\xrightarrow{KHSO_4}$ (B); compound (B) is

(a) $H_2C=CH–CH_2–OH$

(b) $H_2C=CH–COOH$

(c) $H_2C=CH–CHO$

(d) $H_2C=C=CH_2$

30. $CH_3–CH_2–CH_2–CH_3 \xrightarrow[600°C]{CrO_3/Al_2O_3}$ [P]; Product is

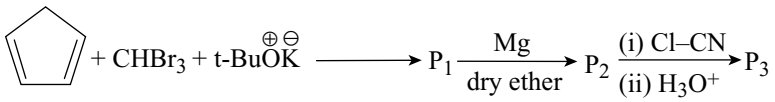
(a) Mixture of 1-butene and 2-butene (b) Cyclobutene
(c) 1,3-cyclobutadiene (d) None of these

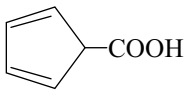
31. In the presence of peroxide, HCl and HI do not give Anti-Markovnikov's additon to alkenes because
(a) All the steps are endothermic in both the cases
(b) One is oxidising and other is reducing
(c) One of the steps is endothermic in both the cases
(d) All the steps are exothermic in both the cases

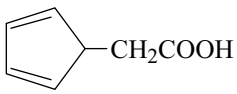
32. Hydrogenolysis is a process of
(a) Addition of H_2 across C—C multiple bond
(b) Elimination of H_2 in CH–CH bonds
(c) Cleavage of a single bond by H_2
(d) Cleavage of C—C multiple bonds by H_2

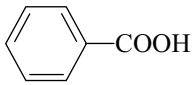
33. In the reaction with Tollen's reagent actylene shows
(a) Oxidising property (b) Reducing property
(c) Basic property (d) Acidic property

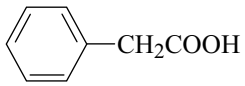
34. Arrange the following halogenating agents in order of decreasing selectivity in free radical reactions
(i) NBS (ii) NCS (iii) Cl_2 (iv) F_2
(a) iv > iii > ii > i (b) i > ii > iii > iv (c) ii > i > iii > iv (d) i > ii > iv > iii

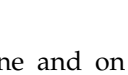
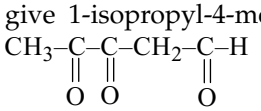
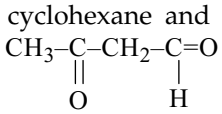
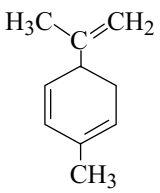
35. 

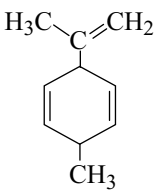
The product P_3 is
(a) 

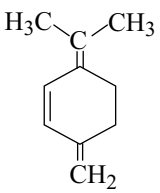
(b) 

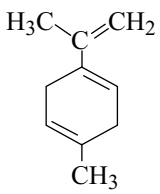
(c) 

(d) 

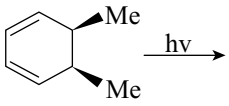
36. A compound having the molecular formula $C_{10}H_{14}$ is hydrogenated with H_2/Pd to give 1-isopropyl-4-methyl cyclohexane and on reductive ozonolysis it gives  ,  and 
The structure of the compound would be
(a) 

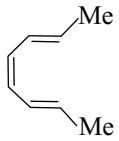
(b) 

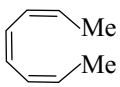
(c) 

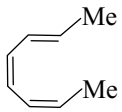
(d) 

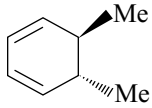
37. The product obtained during the following photochemical reaction is



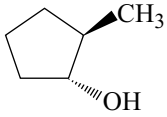
(a) 

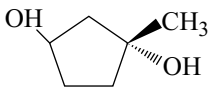
(b) 

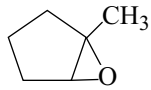
(c) 

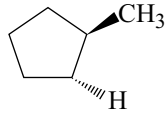
(d) 

38. The major product formed on hydroboration oxidation of 1-methylcyclopentene is

(a) 

(b) 

(c) 

(d) 

39. Compound (A) on bromination gives (B), which gives (C) with alcoholic KOH. (C) decolouries 1% alkaline $KMnO_4$ solution and on ozonolysis, it gives two molecules of smallest carbonyl compound. Compound (A) will be

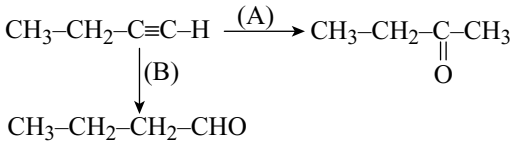
(a) C_2H_2 (b) C_2H_4 (c) C_2H_6 (d) C_2H_5Cl

40. CH_2=CH–C≡CH on reaction with 1 mole of DBr gives

(a) CH_2=CH–CBr=CHD (b) CH_2(Br)–CHDC≡CH

(c) DCH_2–CHBrC≡CH (d) CH_2=CH–CD=CHBr

41. In the given reaction, A and B respectively are



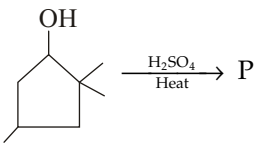
(a) $(Sia)_2BH/H_2O_2/HO^-$ and $H_2O/HgSO_4/H^\oplus$

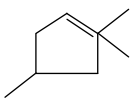
(b) $H_2O/HgSO_4/H^\oplus$ and $(Sia)_2BH/H_2O_2/HO^-$

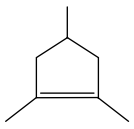
(c) $H_2O/HgSO_4/H^\oplus$ and Na, CH_3–I

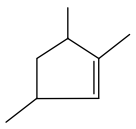
(d) None

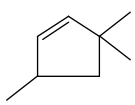
42. Identify the major product P obtained by the reaction



(a) 

(b) 

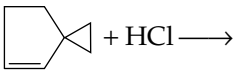
(c) 

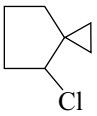
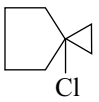
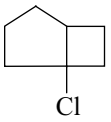
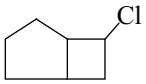
(d) 

43. During the preparation of ethane by Kolb's electrolytic method using inert electrode the pH of the electrolyte

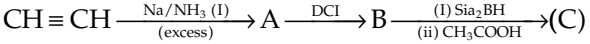
(a) Decreases progressively as the reaction proceeds
(b) Increases progressively as the reaction proceeds
(c) Remains constant throughout the reaction
(d) May decrease if concentration of the electrolytes is not very high

44. Major product obtained by the following reaction is

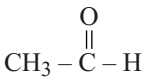
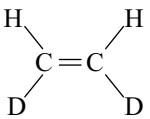
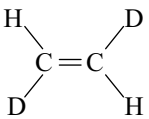


(a) 
(b) 
(c) 
(d) 

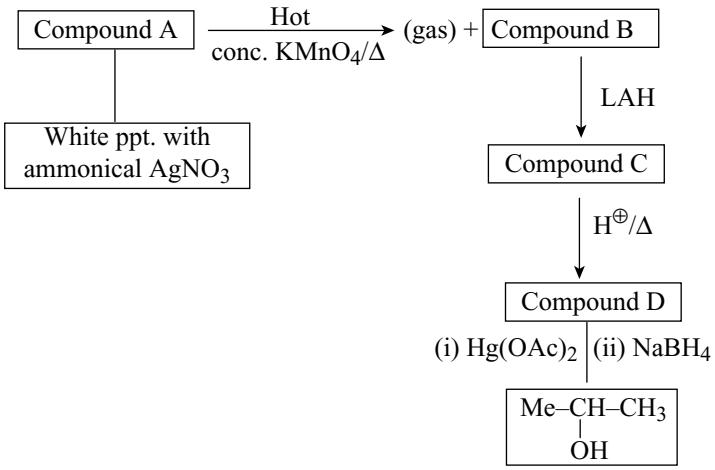
45. In the reaction



the product (C) is

(a) D – C ≡ C – D (b)  (c)  (d) 

46. Identify structure of compound [A]



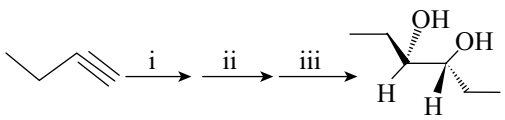
(a) Me–C≡C–Me (b) Me–CH_2–C≡CH
(c) Me–CH=CH–Me (d) Me–CH_2–CH=CH_2

47. The reaction of propene with HBr in the presence of ROOR (peroxide) proceeds through which of the following most stable intermediates?

(a) $CH_3 - \dot{C}H - CH_3$ (b) $CH_3 - \dot{C}H - CH_2Br$

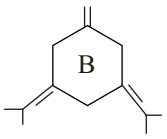
(c) CH_3–$\underset{\displaystyle Br}{\underset{|}{CH}}$–$\dot{C}H_2$ (d) $CH_3 - CH_2 - \dot{C}H_2$

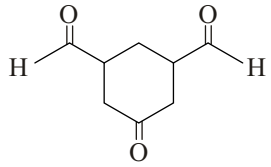
48. The following transformation is carried out in three steps. What is the appropriate reagent for the first step?

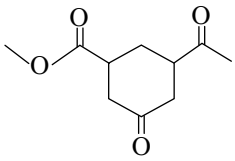


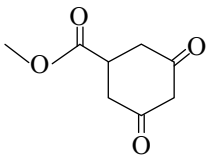
(a) H_2/Lindlar's catalyst
(b) $C_2H_2/NaNH_2/CH_3I$
(c) $NaNH_2/NH_3$: EtBr
(d) H_2/Pd/C

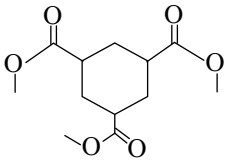
49. Compound A was treated with a large excess of CH_3MgBr. The resulting product was exposed to $POCl_3$/pyridine to give compound B, as one of many products. Which of the following compound can be A?



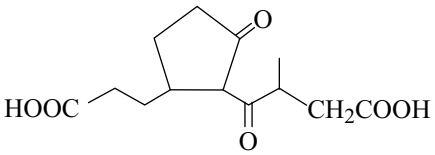
(a) 

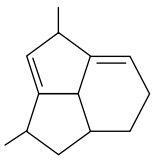
(b) 

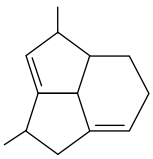
(c) 

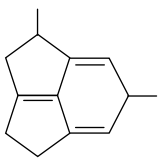
(d) 

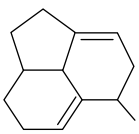
50. Which molecule will give the following dicarboxylic acid upon treatment with acidic solution of $KMnO_4/\Delta$?



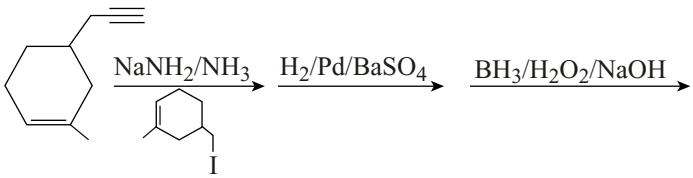
(a) 

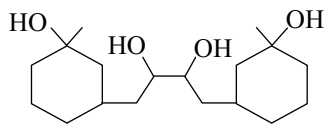
(b) 

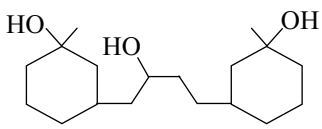
(c) 

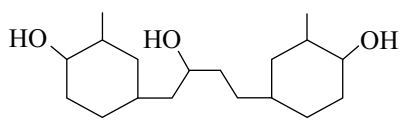
(d) 

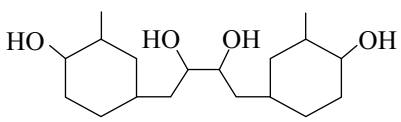
51. What is the product of the following sequence of reaction?



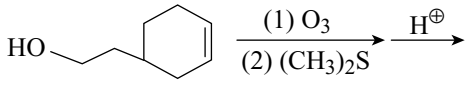
(a) 

(b) 

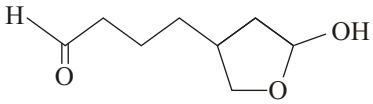
(c) 

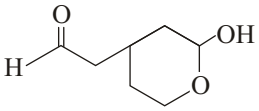
(d) 

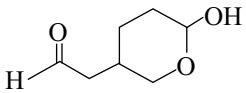
52. Give the major product of the following sequence

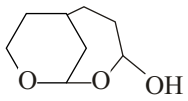


(Major product)

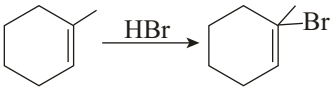
(a) 

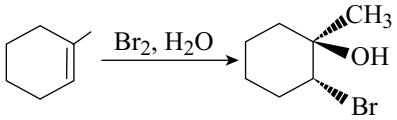
(b) 

(c) 

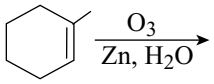
(d) 

53. Which of the following reactions involve a radical mechanism?

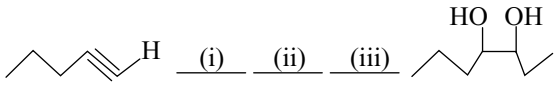
(a) 

(b) 

(c) 

(d) 

54. For the following multistep reaction, which set of reagents would be more likely to give the desired product in good yield?



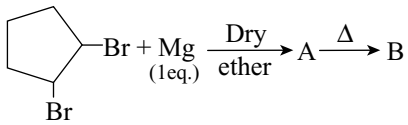
(a) (i) HBr, (ii) O_3/Zn–H_2O, (iii) Li/NH_3

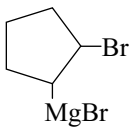
(b) (i) $NaNH_2/NH_3/C_2H_5I$, (ii) Lindlar's catalyst/H_2 (iii) OsO_4 followed by $NaHSO_3$

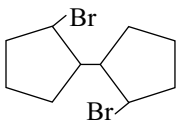
(c) (i) H_2/Pd-C, (ii) $NaNH_2/NH_3$ followed by C_2H_5I, (iii) $KMnO_4/OH^-$

(d) (i) $HgSO_4/H_2SO_4$, (ii) Lindlar's catalyst/H_2, (iii) OsO_4 followed by $NaHSO_3$

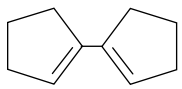
55. In the following reaction, compound (B) is



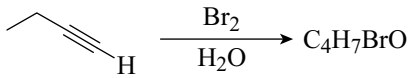
(a) 

(b) 

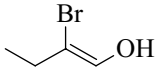
(c) 

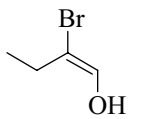
(d) 

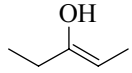
56. Here is a reaction

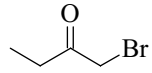


Use your knowledge of mechanisms to choose the most likely product from among the following compounds.

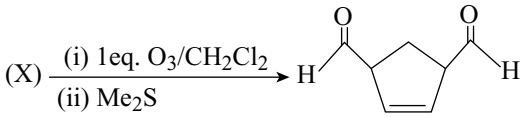
(a) 

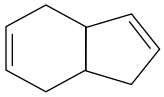
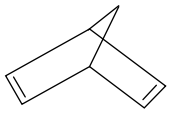
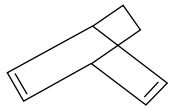
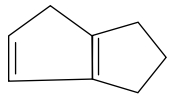
(b) 

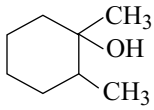
(c) 

(d) 

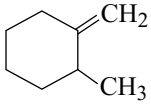
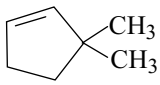
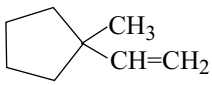
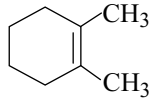
57. Identify the reactant (X) on the given reaction



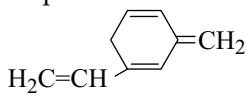
(a)  (b)  (c)  (d) 

58. Compound (A) $\xrightarrow{\text{dil. } H_2SO_4}$ 

Compound (A) can be

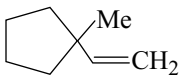
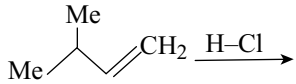
(a)  (b)  (c)  (d) 

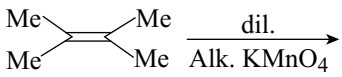
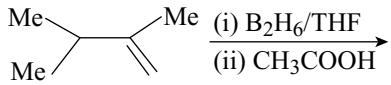
59. Which of the following gives glyoxal as one of the product on ozonolysis?

(a)  (b) 

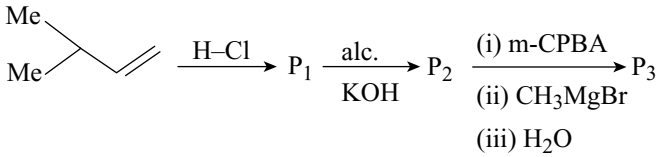
(c) $H_2C{=}CH{-}CH{=}CH_2$ (d) Benzene

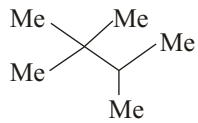
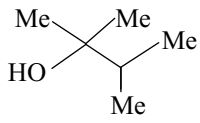
60. In which of the following reaction the rearrangment of carbocation is involved?

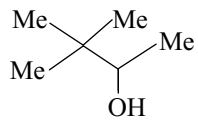
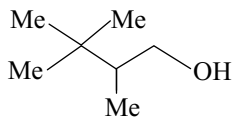
(a)  (b) 

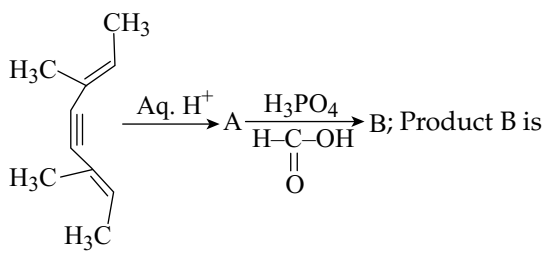
(c)  (d) 

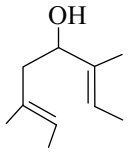
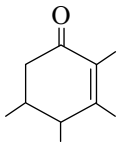
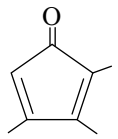
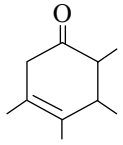
61. The final product of the given reaction is



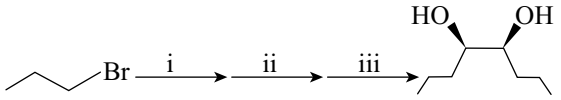
(a)  (b) 

(c)  (d) 

62. 

(a)  (b)  (c)  (d) 

63. Choose the best reagent to carry out the following sequence of reaction



i **ii** **iii**

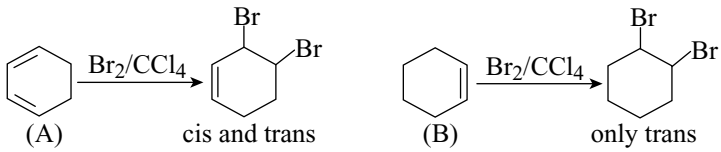
(a) Acetylene/$NaNH_2/NH_3 H_2/Pd$ $OsO_4/NaHSO_3$

(b) Acetylene/$NaNH_2/NH_3 H_2$/Lindlar's catalyst $BH_3/NaOH/H_2O_2$

(c) Pentyne/$NaNH_2/NH_3$ Li/NH_3 MnO_4

(d) Pentyne/$NaNH_2/NH_3 H_2$/Lindlar's catalyst $OsO_4/NaHSO_3$

64. When cyclohexadiene (A) reacts with Br_2, a mixture of cis- and trans-1, 2-addition products is formed (in addition to other products). However, when cyclohexene (B) reacts with Br_2 under identical conditions, only trans product is observed. What is the best explanation for the observed difference in stereochemistry of the addition?



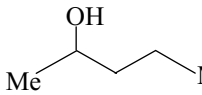
(A) cis and trans (B) only trans

(a) The cis and trans products are the result of aromaticity in the cyclic TS for reaction of A. In B there are only four electrons in TS, and cyclic TS is destabilised.

(b) Reaction of A proceeds through an intermediate that has an sp^3-hybridised carbocation, while the analogous intermediate in reaction of B has sp^2-hybridised carbocation.

(c) Both reactions occur through bromonium ions, but because of planarity enforced by neighbouring double bond, cis addition is not sterically hindered in A.

(d) B reacts through a bromonium ion intermediate, while A does through an allyl cation.

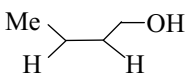
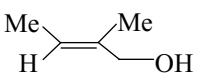
65.  $\xrightarrow[\text{Heat}]{H_2SO_4}$ number of product (x) $\xrightarrow{Br_2/CCl_4}$ number of products (y).

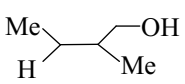
The (x) and (y) are respectively

(a) ii, 4 (b) ii, 3 (c) iii, 6 (d) iii, 5

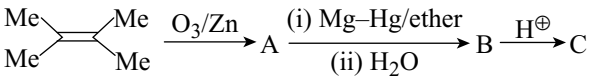
66. Final product in the given sequence is

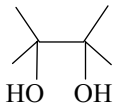
$$Me{-}C{\equiv}CH \xrightarrow[-[A]\uparrow]{MeMgBr} [B] \xrightarrow[II\ NH_4Cl]{I\ H_2CO} [C] \xrightarrow[Pd-BaSO_4]{H_2} [D]$$

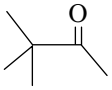
(a)  (b) 

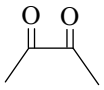
(c)  (d) None of these

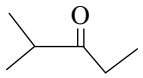
67. Identify "C" product in the given reaction



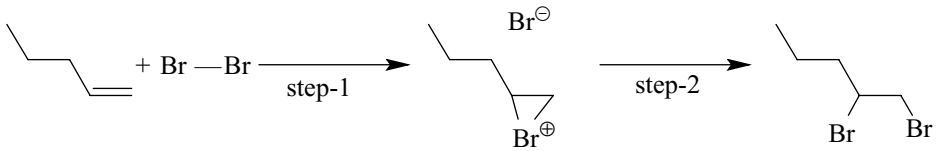
(a) 

(b) 

(c) 

(d) 

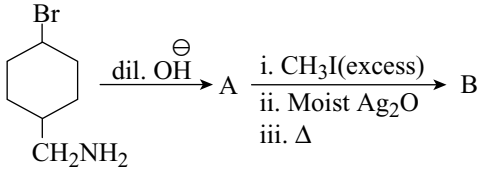
68. Consider the following reaction.

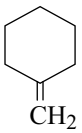


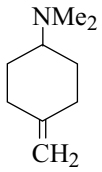
Which one of the following statements is incorrect?

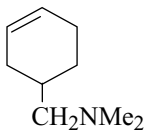
(a) The Br_2 addition occurs with anti-stereospecificity.
(b) The final product will be a mixture of enantiomers.
(c) In step 2 the Br- anion acts as a Lewis base.
(d) In step 1 the Br_2 molecule acts as a Lewis base.

69. Identify the product in the following sequence of reaction



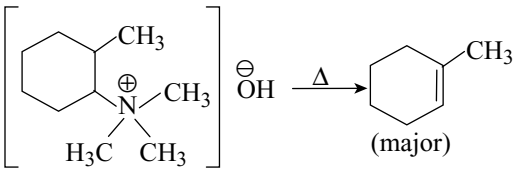
(a) 

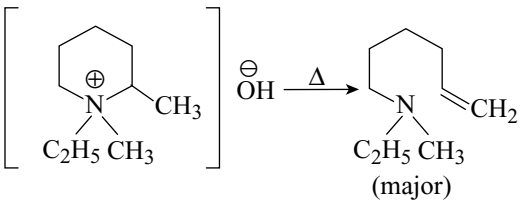
(b) 

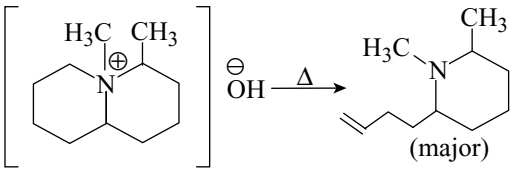
(c) 

(d) 

70. Which of the following is correctly matched?

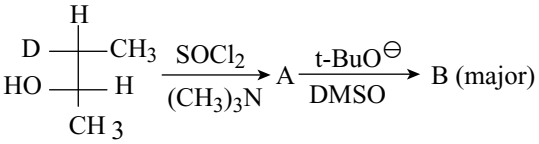
(a) 

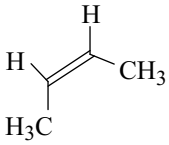
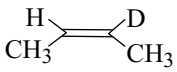
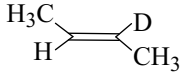
(b) 

(c) 

(d) All of these

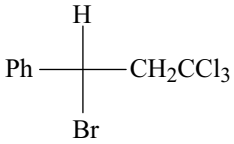
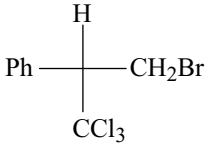
71. The final product of the given reaction sequence is

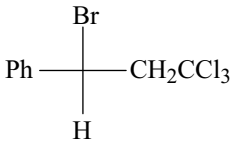
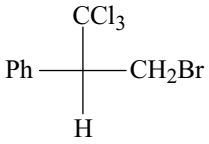


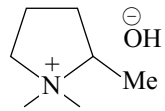
(a)  (b)  (c)  (d) none of these

72. $Ph–CH=CH_2 + BrCCl_3 \xrightarrow{\text{peroxide}}$

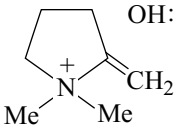
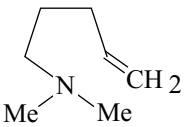
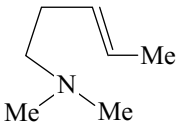
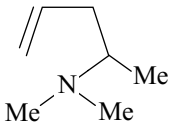
Product is

(a)  (b) 

(c)  (d) 

73. 

The above compound readily undergoes elimination on heating to yield which of the following products?

(a)  (b)  (c)  (d) 

74. Select true statement(s)

(a) Instead of radical substitution, cyclopropane undergoes electrophilic addition reactions in sun light.

(b) In general, bromination is more selective than chlorination.

(c) The 2, 4, 6-tri-tert,butylphenoxy radical is resistant to dimerisation.

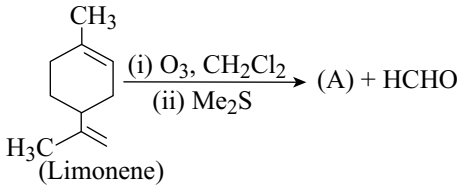
(d) The radical-catalysed chlorination, $ArCH_3 \rightarrow ArCH_2Cl$, occurs faster when Ar = phenyl than when Ar = p-nitrophenyl.

75. Which reagent is the most useful for distinguishing compound i from the rest of the compounds?

$CH_3CH_2C{\equiv}CH$	$CH_3C{\equiv}CCH_3$	$CH_3CH_2CH_2CH_3$	$CH_3CH{=}CH_2$
(i)	(ii)	(iii)	(iv)

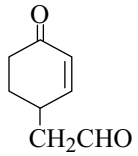
(a) alk. $KMnO_4$ (b) Br_2/CCl_4

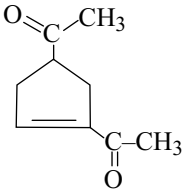
(c) Br_2/CH_3COOH (d) Ammonical $AgNO_3$

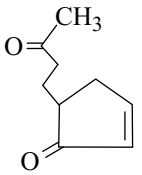
76. 

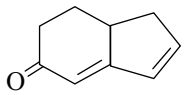
(A) $\xrightarrow[\Delta]{\text{dil. } \overset{\oplus}{O}H}$ products (mixture)

For the given reaction, the products are

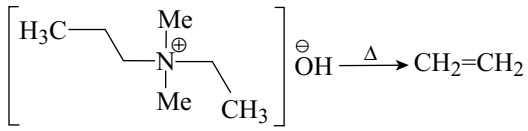
(a) 

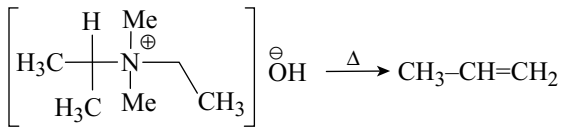
(b) 

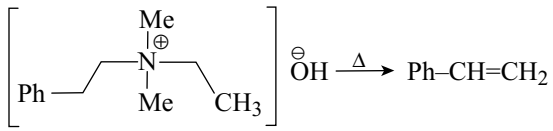
(c) 

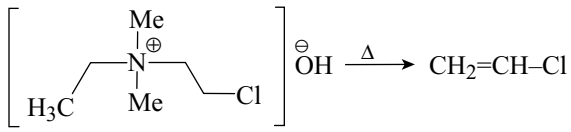
(d) 

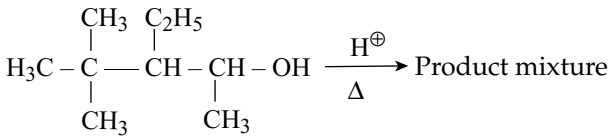
77. Which of the following reaction is correct regarding the formation of major product (alkene)?

(a) 

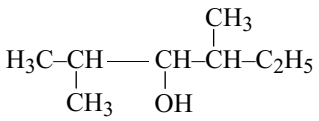
(b) 

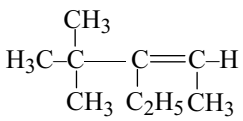
(c) 

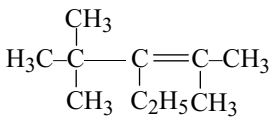
(d) 

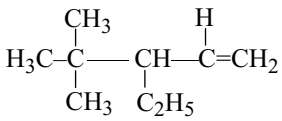
78. 

the product's mixture contains

(a) 

(b) 

(c) 

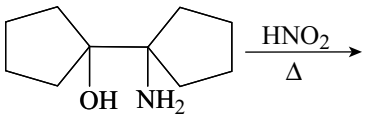
(d) 

79. Which of the following reaction does/do not takes place by formation and rearrangement of carbocation?

(a) $R-\underset{\underset{CH_3}{|}}{CH}-CH=CH_2 \xrightarrow[\text{(ii) } NaBH_4]{\text{(i) } Hg(OAc)_2,\ H_2O}$

(b) $R-\underset{\underset{CH_3}{|}}{CH}-CH=CH_2 \xrightarrow[\text{(ii) } H_2O_2]{\text{(i) } BH_3}$

(c) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2 \xrightarrow[\text{Peroxide}]{HBr}$

(d) 

80. Which alkyl halide will form Wittig reagent with PPh_3 and C_6H_5Li?

(a) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-Br$ (b) $CH_3-\underset{\underset{CH_3}{|}}{CH}-Br$ (c) CH_3-Br (d) C_6H_5-Br

81. Alkyne can be converted into vic dicarbonyl compound by

(a) SeO_2 (b) Baeyer's reagent (c) $KMnO_4/H^{\oplus}$ (d) $K_2Cr_2O_7$

82. Which of these substrates will give rearranged product in hydration reaction?

(a) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH=CH_2$

(b) $CH_3-\ddot{\underset{\cdot\cdot}{S}}-CH_2-CH=CH_2$

(c) $CH_3-CH=CH_2$

(d) $\begin{matrix} Ph \\ Ph \end{matrix}\!\!>\!C=CH-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$

83. The reagent(s) of choice for conversion of propene to methylcyclopropane is/are

(a) CH_2N_2/ether (b) CH_2I_2 (c) CH_2I_2/Zn (d) $CH_3I/NaOH$

84. Anti-Markonikov addition is given by which of the following alkenes?

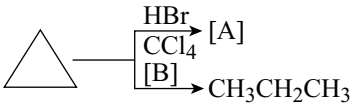
(a) $CH_2=CH-\overset{\oplus}{N}(CH_3)_3$ (b) $CH_2=CH-CF_3$ (c) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2$ (d) $C_6H_5-CH=CH_2$

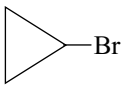
85. Which of the following gives allylic substitution product?

(a) $CH_2=CH-CH_3 \xrightarrow{NBS/hv}$ product (b) $CH_2=CH-CH_3 \xrightarrow[\Delta]{SeO_2}$ product

(c) $CH_2=CH-CH_3 \xrightarrow{OsO_4}$ product (d) $CH_2=CH-CH_3 \xrightarrow[hv]{SO_2Cl_2}$ product

86. In the given reaction, identify compound [A]



(a) Compound [A] is 

(b) Compound A is $CH_3CH_2CH_2Br$

(c) Reagent B is H_2/Ni at 120°C

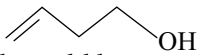
(d) Reagent B is $LiAlH_4$

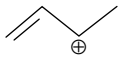
87. In which of the following Hoffman's elemination product is more?

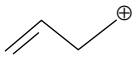
(a) $CH_3-\underset{\underset{H_3C}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{\text{conc. } H_2SO_4}$

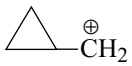
(b) $CH_3-\underset{\underset{H_3C}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow[\text{t-butoxide}]{\text{Potassium}}$

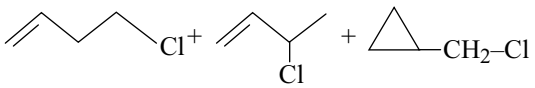
(c) $CH_3–CH_2–CH_2–CH_2–\overset{\oplus}{N}(CH_3)_3$ $\xrightarrow[(ii)\ \Delta]{(i)\ AgOH}$ (d) $CH_3–\underset{CH_3}{\overset{CH_3}{C}}–CH_2–Cl$ $\xrightarrow{\text{Alc. KOH}}$

88. When  is treated with HCl then different carbocations and products formed would be

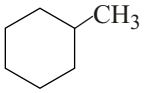
(a) 

(b) 

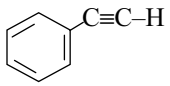
(c) 

(d) 

89. Which of the following compounds can give bromination reaction with NBS/hv?

(a) $CH_3–C\equiv CH$ (b)  (c) $CH_3–\underset{CH_3}{CH}–CH_3$ (d) $C_6H_5–CH_3$

90. Which of the following alkynes show acidic character?

(a) $H–C\equiv C–H$ (b) $CH_3–C\equiv C–H$ (c)  (d) $CH_3–C\equiv C–CH_3$

91. Aqueous solution of which of the following compounds is electrolysed, when acetylene gas is obtained?

(a) Sodium fumerate (b) Sodium maleate

(c) Sodium acetate (d) Calcium carbide

92. Which of the following acid will give isopentane on decarboxylation with soda lime?

(a) $CH_3–\underset{CH_3}{\overset{COOH}{C}}–CH_2–CH_3$ (b) $CH_3–\underset{CH_3}{\overset{COOH}{CH}}–CH–CH_3$

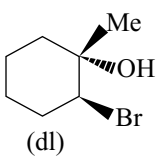
(c) $CH_2(COOH)–\underset{CH_3}{CH}–CH_2–CH_3$ (d) $CH_3–\underset{CH_3}{CH}–CH_2–COOH$

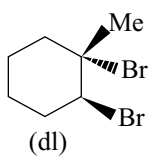
93. Which of the following alkane cannot be synthesised by Wurtz reaction in good yield?

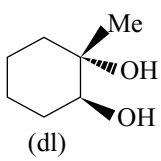
(a) $(CH_3)_2–CH–CH_2–CH–(CH_3)_2$ (b) $(CH_3)_2CH–CH_2–CH_2–CH–(CH_3)_2$

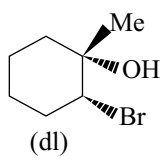
(c) $CH_3–CH_2–C(CH_3)_2–CH_2–CH_3$ (d) $CH_3–CH_2–CH_2–CH_3$

94.  $\xrightarrow{Br_2/H_2O}$ major product of the reaction is

(a)  (dl)

(b)  (dl)

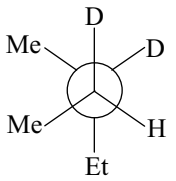
(c)  (dl)

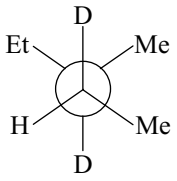
(d)  (dl)

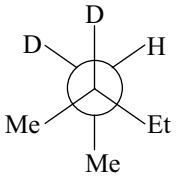
95. Identify per cent yield of 2°-chlorination product of 2-methyl butane (Excluding stereo-isomer), If propane on monochlorination gives 1-chloro and 2-chloro propane in 45% and 55% yield respectively and isobutane on monochlorination gives 1°-chloro and 3°-chloro product in 65% and 35% yield, respectively

(a) 40% (b) 31.28% (c) 54.3% (d) 34.28%

96. Identify major product of reaction of (E)-3-methyl-2-pentene with D_2/Ni

(a) 

(b) 

(c) 

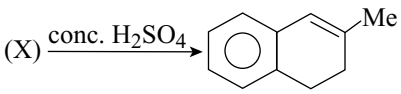
(d) (a) and (c) both

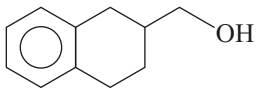
97. Test for identification of But-2-ene and benzene is

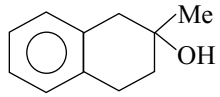
(a) Tollen's Reagent test (b) 1% Alkaline $KMnO_4$

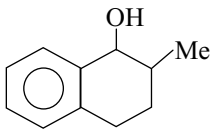
(c) Iodoform test (d) $Br_2 + H_2O$ test

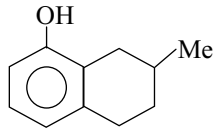
98. In the given reaction, the possible structure of compound (X) is



(a) 

(b) 

(c) 

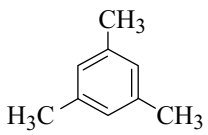
(d) 

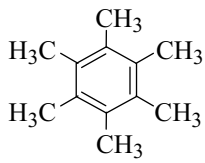
99. Which of the following reactions will give an alkyne?

(a) Potassium fumarate $\xrightarrow{\text{Electrolysis}}$ (b) $CH_3CBr_2CHBr_2 \xrightarrow{\text{Zn dust}}$

(c) $CH_3CH_2CHBr_2 \xrightarrow{\text{alc. KOH/NaNH}_2/\Delta}$ (d) $CH_3CHBrCH_2Br \xrightarrow{\text{NaNH}_2/\Delta}$

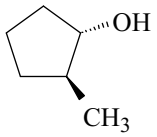
100. $4HC{\equiv}CH \xrightarrow[\text{iron tube}]{\text{red hot}}$ "X". "X" is

(a) Benzene (b)  (c) 

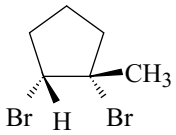
(d) 

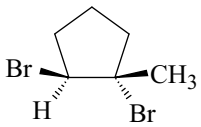
LEVEL 2

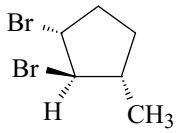
Single and Multiple-choice Type

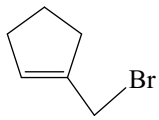
1. 

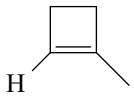
1. H_2SO_4 / heat
2. Br_2 / $CHCl_3$
→ Product

(a) 

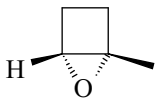
(b) 

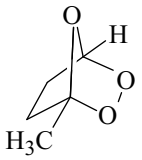
(c) 

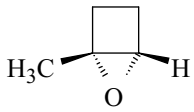
(d) 

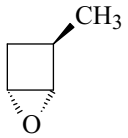
2. 

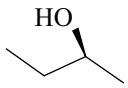
MCPBA → Product

(a) 

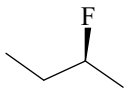
(b) 

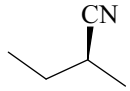
(c) 

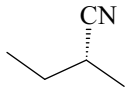
(d) 

3. 

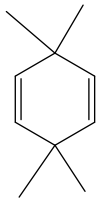
1. TsCl, pyridine
2. NaCN / DMF
→ Product

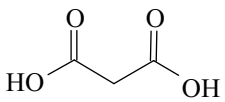
(a) 

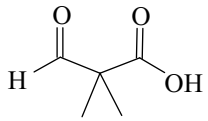
(b) 

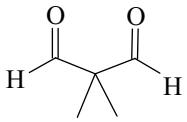
(c) 

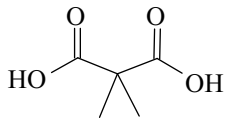
(d) 

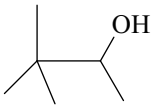
4. 
1. Excess O_3
2. H_2O_2
→ Product

(a) 

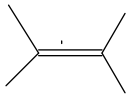
(b) 

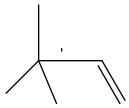
(c) 

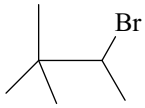
(d) 

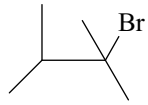
5. 

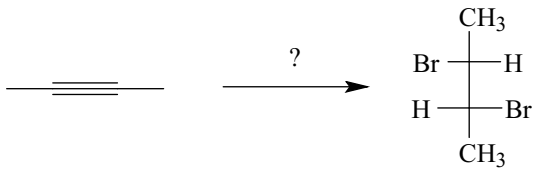
conc. HBr → Product is?

(a) 

(b) 

(c) 

(d) 

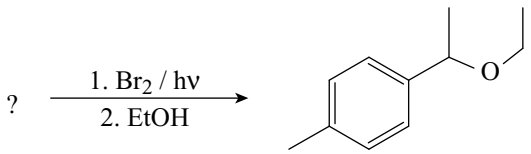
6. 

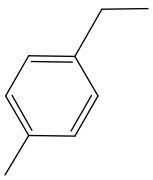
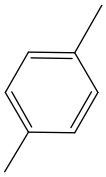
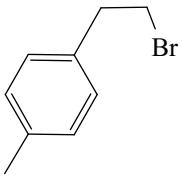
(a) (i) Na/NH_3 (l) (ii) $Br_2/CHCl_3$

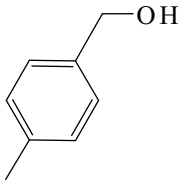
(b) (i) $H_2/Pd/CaCO_3$/pyridine (ii) HBr

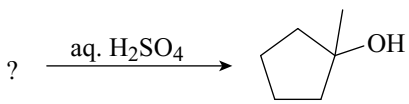
(c) (i) excess H_2/Pd (ii) Br_2, uv light

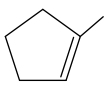
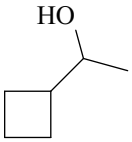
(d) (i) $H_2/Pd/CaCO_3$/pyridine (ii) $Br_2/CHCl_3$

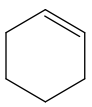
7. 

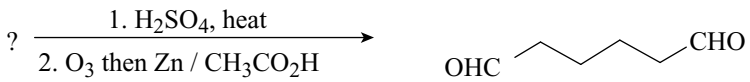
(a)  (b)  (c) 

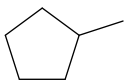
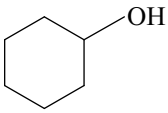
(d) 

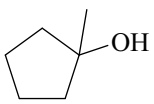
8. 

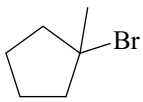
(a)  (b) 

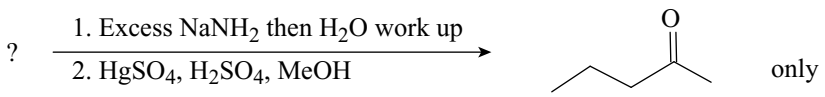
(c)  (d) 

9. 

(a)  (b) 

(c) 

(d) 

10. 

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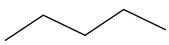
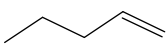
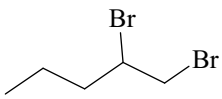
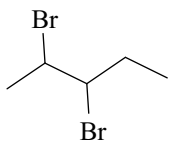
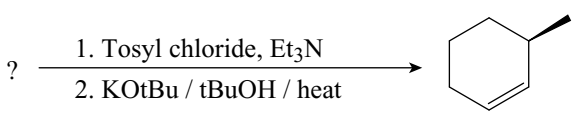
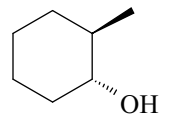
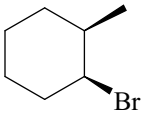
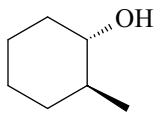
(a)  (b)  (c) 

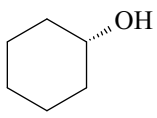
(d) 

11. 

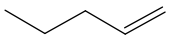
(a) 

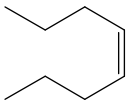
(b) 

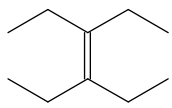
(c) 

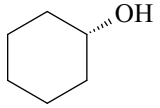
(d) 

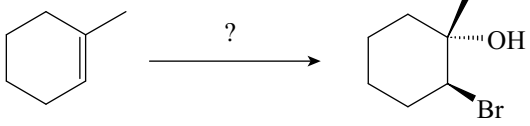
12. ? $\xrightarrow[\text{2. } Na_2CO_3 \text{ / } CH_3I \text{ / DMF}]{\text{1. } O_3 \text{ then } H_2O}$ $CH_3CH_2CH_2CO_2CH_3$ only

(a) 

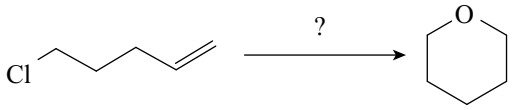
(b) 

(c) 

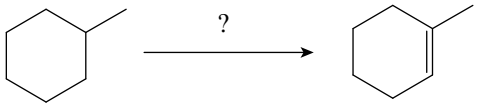
(d) 

13. 

(a) (i) $Br_2/CHCl_3$ (ii) NaOH
(b) (i) NaOH (ii) NaBr
(c) (i) BH_3 then $NaOH/H_2O_2$ (ii) HBr
(d) Br_2/H_2O

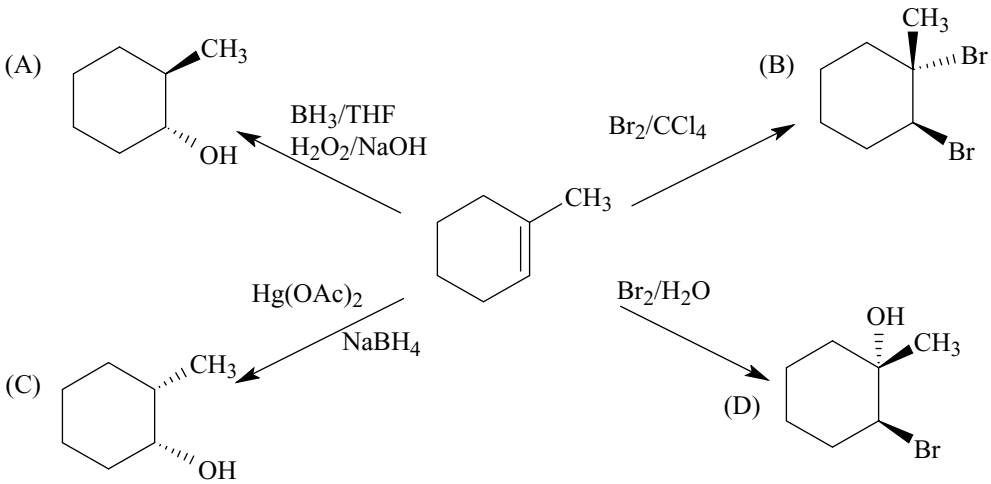
14. 

(a) (i) H_2O (ii) NaOH
(b) (i) aq. H_2SO_4 (ii) Na
(c) HBr/peroxides (ii) NaI/acetonei
(d) (i) BH_3 then $NaOH/H_2O_2$

15. 

(a) heat H_2/Pd
(b) (i) HCl (ii) KOH/EtOH/heat
(c) (i) $SOCl_2/Et_3N$ (ii) KOH/EtOH/heat
(d) (i) Br_2/hv (ii) KOH/EtOH/heat

16. Identify the correct reaction sequence



17. Which of the following is most reactive towards aqueous HBr?

(a) 1-Phenyl-2-propanol (b) 1-Phenyl-1-propanol

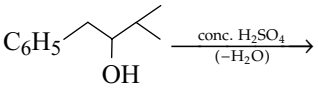
(c) 3-Phenyl-1-propanol (d) 2-Phenyl-1-propanol

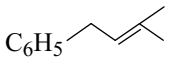
18. Ethylbenzene when treated with chlorine in the presence of light mainly gives

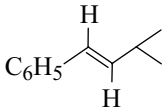
(a) β-phenylethyl chloride (b) α-phenylethyl chloride

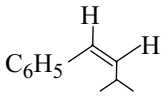
(c) o-chloroethyl benzene (d) o- and p-chloroethylbenzene

19. When the following alcohol is treated with conc. H_2SO_4, the major product obtained is

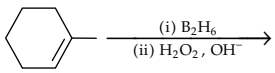


(a) 

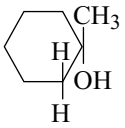
(b) 

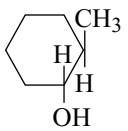
(c) 

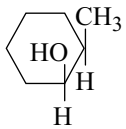
(d) All the three will be formed in equal amounts

20. 

X. The compound X is

(a) 

(b) 

(c) 

(d) Both (b) and (c)

21. Give the nature of A and B in the given reaction

$$B \xleftarrow[H^+]{KMnO_4} (CH_3)_3COH \xrightarrow{KMnO_4/OH^-} A$$

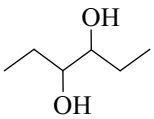
(a) A and B both are $(CH_3)_2C = CH_2$

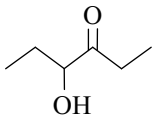
(b) A and B both are $(CH_3)_2CO + CH_2O$

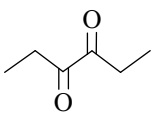
(c) A is $(CH_3)_3COH$, while B is $(CH_3)_2C = CH_2$ or $(CH_3)_2CO$

(d) A and B both are $(CH_3)_3COH$, i.e., there is no reaction

22. Which of the following is liable to be oxidised by periodic acid?

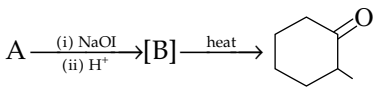
(a) 

(b) 

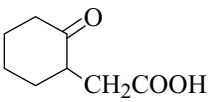
(c) 

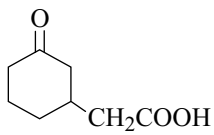
(d) All the three

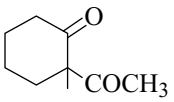
23. From the given set of reaction

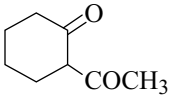


starting compound A corresponds to

(a) 

(b) 

(c) 

(d) 

24. Methanoic acid is heated with conc. H_2SO_4 to form

(a) CO (b) CO_2 (c) CH_4 (d) $(COOH)_2$

25. When ethane-1,2-dioic acid is heated with conc. H_2SO_4, it gives

(a) CO + HCOOH (b) CO_2 + HCOOH

(c) CO + CO_2 + HCOOH (d) CO + CO_2 + H_2O

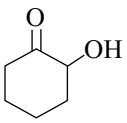
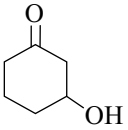
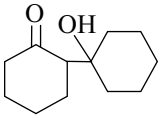
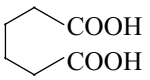
26. When sodium fumrate is heated with soda lime, we get

(a) CH_4 (b) Ethyne (c) Sodium oxalate (d) No action

27. Sodium formate is heated at 360°C to gives

(a) CO (b) CO_2 (c) Sodium oxalate (d) No action

28. When cyclohexanone is treated with Na_2CO_3 solution, we get

(a)  (b)  (c)  (d) 

29. In the given reaction, $CH_3–CH_2–C\equiv C–H \xrightarrow[(ii)\ H_2O_2/OH^-]{(i)\ BH_3}$ [X], [X] will be

(a) Butanal (b) Butanone (c) 2-butanol (d) 1-butanol

30. In the given reaction, $CH_3–C\equiv C–CH_3 \xrightarrow{H_2/Ni_2B/\Delta}$ [X], [X] will be

(a) 1-butene (b) trans-2-butene (c) cis-2-butene (d) 1-butyne

31. In the given reaction, $C_6H_5–C\equiv C–CH_3 \xrightarrow{Na/NH_3(l)}$ [X], [X] will be

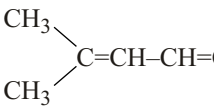
(a) 1-phenyl propane (b) 1-phenyl propene

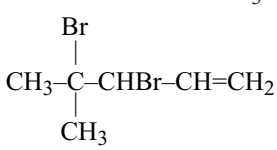
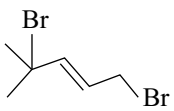
(c) trans-1-phenyl propene (d) cis-1-phenyl propene

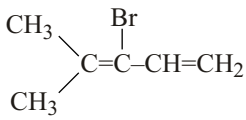
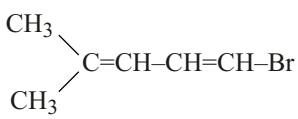
32. In the given reaction, $CH_3–CH_2–C\equiv C–CH_3 + HOH \xrightarrow{HOH/\overset{\oplus}{H}/Hg^{++}}$ [X], [X] will be

(a) 2-pentanone (b) 3-pentanone

(c) Pentanol (d) Mixture of 2-pentanone and 3-pentanone

33. In the given reaction,  $\xrightarrow{-80°C}$ [X], [X] will be

(a)  (b) 

(c)  (d) 

34. In the given reaction, $CH_3–C\equiv CH \xrightarrow{HOBr}$ [X], [X] will be

(a) $CH_3–\overset{\overset{O}{\|}}{C}–CH_2Br$ (b) $CH_3–\overset{\overset{O}{\|}}{C}–CBr_2$ (c) $CH_3–\overset{\overset{O}{\|}}{C}–CHBr_2$ (d) $CH_3–\overset{\overset{OH}{|}}{C}=CHBr$

35. 8 mL of a gaseous hydrocarbon needs 40 mL of oxygen for its complete combustion. The hydrocarbon is

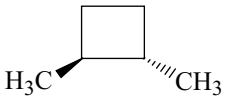
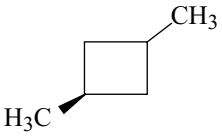
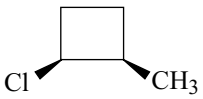
(a) CH_4 (b) C_3H_4 (c) C_3H_8 (d) C_3H_6

36. 0.34 g of a hydrocarbon when heated with methyl magnesium bromide gives 112 mL of CH_4 at STP. Possible structure of the hydrocarbon is

(a) $CH_3CH_2CH_2C\equiv CH$ (b) $CH_3CH_2C\equiv C–CH_3$

(c) $CH_3CH_2–\underset{\underset{CH_3}{|}}{CH}–C\equiv CH$ (d) $CH_3CH_2CH_2CH_2C\equiv CH$

37. Which of the following structures are chiral?

(i)  (ii)  (iii) 

(a) i and iii (b) All of the three (c) i and ii (d) ii and iii

38. The lowest boiling point is expected for

(a) Isooctane (b) n-octane (c) 2,2,3, trimethyl butane (d) n-heptane

39. $CH_3–\underset{\underset{MgBr}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_3 + D_2O \longrightarrow$ X. "X" is

(a) $CH_3–\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_3$ (b) $CH_3–\underset{\underset{D}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_3$ (c) $CH_3–\underset{\underset{OD}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_3$ (d) $CH_3–\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_3$

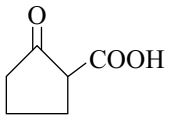
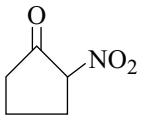
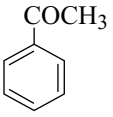
40. Acetic acid, when reacts with excess of HI in the presence of red phosphorus gives

(a) Ethanol (b) Ethane (c) Acetaldehyde (d) Acetone

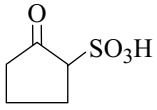
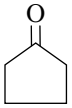
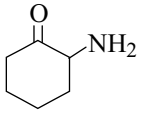
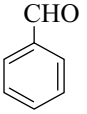
41. Sodium adipate, on electrolysis gives

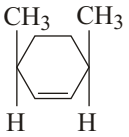
(a) Cyclobutane (b) Cyclopropane (c) But-2-ene (d) But-2-yne

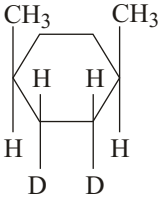
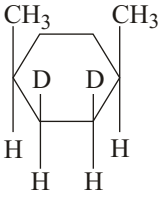
42. Clemensen reduction cannot be used in which of the following?

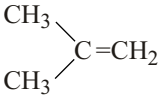
(a)  (b)  (c) $CH_3–\overset{\overset{O}{\|}}{C}–H$ (d) 

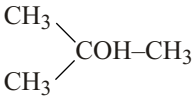
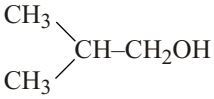
43. Wolff Kishner reduction cannot be used in which of the following?

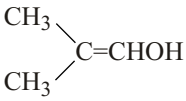
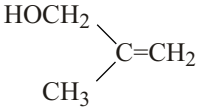
(a)  (b)  (c)  (d) 

44. In the given reaction,  $\xrightarrow{D_2/Ni/\Delta}$?, product will be?

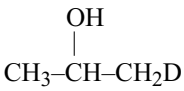
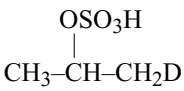
(a)  (b)  (c) Both (d) 70% (a) and 30% (b)

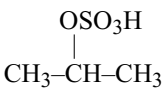
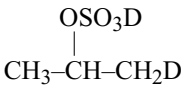
45. In the given reaction,  $\xrightarrow[(ii)\ NaOH/H_2O_2]{(i)\ BH_3}$ [X], [X] will be

(a)  (b) 

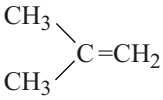
(c)  (d) 

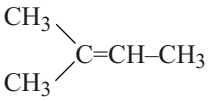
46. In the given reaction, CH_3–CH=CHD $\xrightarrow{Conc.\ H_2SO_4}$ [X], [X] will be

(a)  (b) 

(c)  (d) 

47. Arrange the following compounds in decreasing order of their heat of hydrogenation

(i) CH_3–CH=CH_2 (ii) 

(iii)  (iv) CH_3–CH=CH–CH_3

Select the correct answer

(a) i, iv, ii, iii (b) i, iv, iii, ii (c) iii, ii, iv, i (d) iii, ii, i, iv

48. Arrange stability of the given compounds in decreasing order

(i) CH_2=C=CH_2 (ii) CH_2=CH–CH=CH_2

(iii) CH_2=CH–CH_2–CH_2–CH=CH_2 (iv) C_6H_6

Select the correct anwer

(a) ii, iv, i, iii (b) iv, ii, iii, i (c) iv, ii, i, iii (d) ii, iv, iii, i

49. $2C_2H_5Cl + Zn \longrightarrow CH_3CH_2CH_2CH_3 + ZnCl_2$. The reaction is known as

(a) Frankland reaction (b) Wurtz reaction

(c) Fittig reaction (d) Wurtz-Fittig reaction

50. When isobutane is chlorinated in the presence of diffused sunlight, then the product formed is

(a) tertiary butyl chloride in major amount

(b) isobutyl chloride in major amount

(c) both 50% each

(d) n-butyl chloride, isobutyl chloride and sec-butyl chloride are formed

51. By which of the following methods, alkanes containing odd number and even number of carbon atoms can be prepared with good yield?

(a) Wurtz reaction (b) Frankland reaction

(c) Riemer Tiemann reaction (d) Groove's process

52. During the halogenation of n-pentane, assuming no regeoselectively, the ratio in which 1-chloropentane, 2-chloropentane and 3-chloropentane are formed is

(a) 1:2:3 respectively (b) 3:2:1 respectively

(c) 9:4:1 respectively (d) 1:1:2 respectively

53. When isobutane is brominated in the presence of diffused sunlight then the product formed is

(a) exclusively tertiary butyl bromide (b) exclusively isobutyl bromide

(c) exclusively n-butyl bromide (d) s-butyl bromide

54. Which of the following statements is correct?

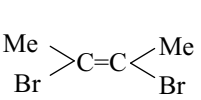
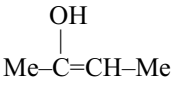
(a) Chlorination of CD_4 is about 12 times faster than the chlorination of CH_4.

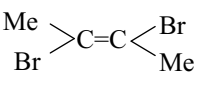
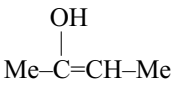
(b) Chlorination of CH_4 is about 12 times faster than the chlorination of CD_4.

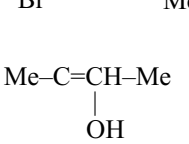
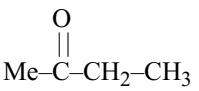
(c) Chlorination of CH_4 and CD_4 takes place at the same step.

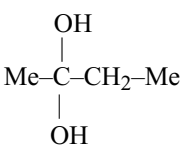
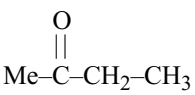
(d) C–H and C–D bond energies are the same.

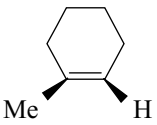
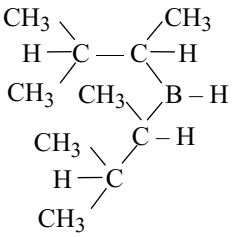
55. When 2-butyne is brominated, A is formed. When 2-butyne is reacted with $HgSO_4 + H_2SO_4$, then B is formed which then gives C. Hence

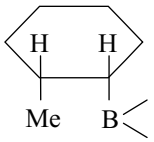
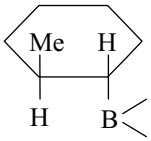
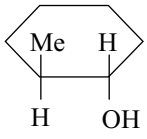
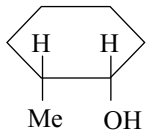
(a) A is  and B is 

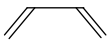
(b) A is  and B is 

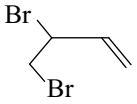
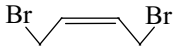
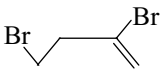
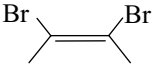
(c) B is  and C is 

(d) B is  and C is 

56. When  is reacted with  followed by treatment with H_2O_2/ OH^-, then the different products formed at different stages are

(a)  (b)  (c)  (d) 

57. When  is treated with Br_2 (1-equivalent), it would give

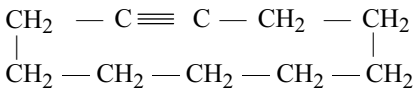
(a)  (b)  (c)  (d) 

58. $(H-C\equiv CLi + Br-(CH_2)_8-Br) \longrightarrow A \xrightarrow{CH_3Li} B \xrightarrow{A} C$

In this reaction, sequences

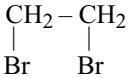
(a) A is H–C≡C–$(CH_2)_8$–Br

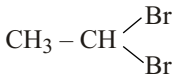
(b) B is H–C≡C–H and C is Li C≡C–$(CH_2)_8$–Br

(c) B is Li C≡C–$(CH_2)_8$–Br and C is 

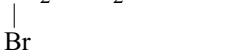
(d) B is Li C≡C–$(CH)_8$–Br and C is Br $(CH_2)_8$ C≡C $(CH_2)_8$ Br

59. When CH_2=CH–Br is reacted with HBr then the product formed is A and when CH_2=CH–COOH is treated with HBr then the product formed is C. Hence here

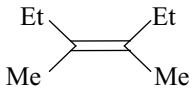
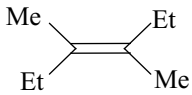
(a) A is 

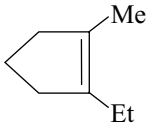
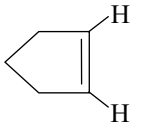
(b) A is 

(c) C is 

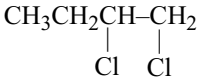
(d) C is 

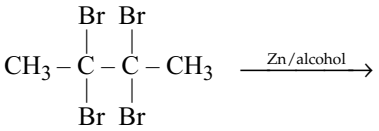
60. Which of the following will give cis diol?

(a)  $\xrightarrow[(ii)\ H_2O/OH^-]{(i)\ KMnO_4}$ (b)  $\xrightarrow[(ii)\ Na_2SO_3]{(i)\ OsO_4}$

(c)  $\xrightarrow[Na_2SO_3]{OsO_4\ 25°C}$ (d)  $\xrightarrow[HCOOH\ 25°C]{35\%\ H_2O_2}$

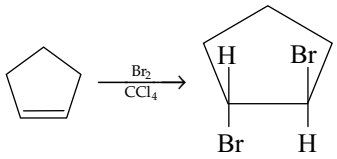
61. Which of the following reactions will give alkyne?

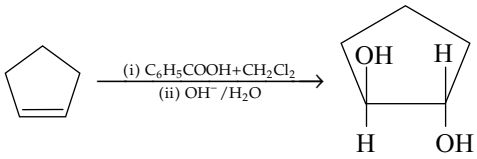
(a)  $\xrightarrow[H_2O]{NaNH_2}$ (b) $CH_3CH_2CHBr_2 \xrightarrow[\Delta]{alc.\ KOH}$

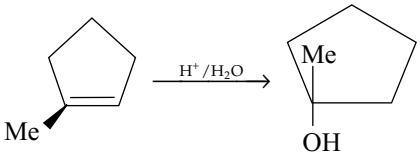
(c) 

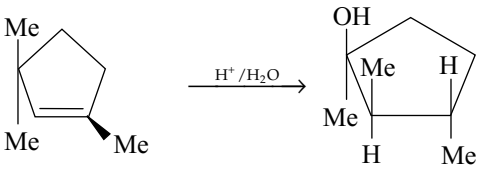
(d) Potassium maleate $\xrightarrow{\text{Electrolysis}}$

62. Which of the following reactins are correct?

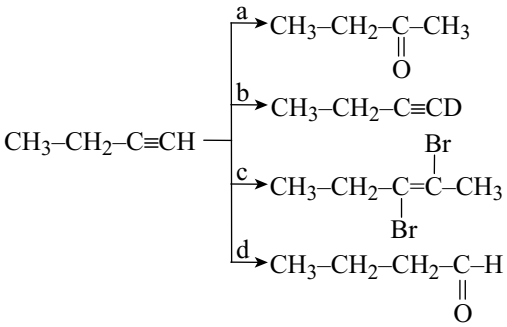
(a) 

(b) 

(c) 

(d) 

63. In the conversion given below



(a) $H_2O/Hg^{2+}/H^+$ (b) (i) one equivalent of LDA, (ii) D_2O

(c) Br_2/CCl_4 (d) (i) $(Sia)_2BH$, (ii) H_2O_2/OH^-

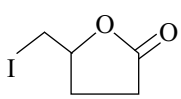
64. Which of the following reactions are correctly represented?

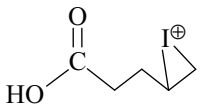
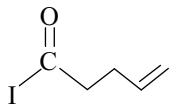
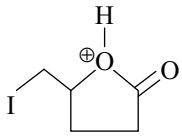
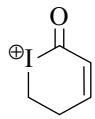
(a) $R–CH=CH_2 + HCl \longrightarrow R–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_3$

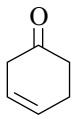
(b) $R–CH=CH_2 + HI \xrightarrow{\text{Peroxide}} R–CH_2–CH_2–I$

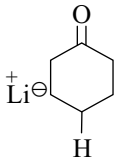
(c) $R–CH=CH_2 + HBr \xrightarrow{\text{Peroxide}} R–CH_2–CH_2–Br$

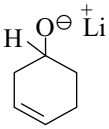
(d) $R–CH=CH_2 + HI \xrightarrow{\text{Peroxide}} R–\underset{\displaystyle I}{\underset{|}{CH}}–CH_3$

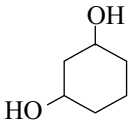
65. The iodo lactisation of  with I_2 gives the compound  + HI. The different intermeidates are

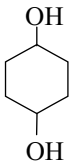
(a)  (b)  (c)  (d) 

66.  $\xrightarrow{LiAlH_4}$ A $\xrightarrow{H^+/H_2O}$ B. Here

(a) A is 

(b) A is 

(c) B may be 

(d) B may be 

67. The reaction of propane with nitric acid in vapour phase gives

(a) 1-nitropropane (b) 2-nitropropane

(c) Nitromethane (d) Nitroethane

68. n-hexane reacts with Pt at 770 K to give

(a) Cyclohexane (b) Benzene (c) Isohexane (d) Neohexane

69. Iodination of methane can be carried out in the presence of

(a) HI (b) HIO_3 (c) HNO_3 (d) NaOH

70. Cracking of alkanes involves

(a) Homolytic fission (b) Free radical

(c) Heterolytic fission (d) Carbocation

71. Arrange reactivity of the given compounds in decreasing order for electrophilic addition reaction

(i) $C_6H_5–CH=CH_2$ (ii) $C_6H_5–\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH–CH_3$

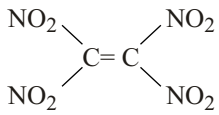
(iii) $C_6H_5–\underset{\displaystyle C_6H_5}{\overset{\displaystyle |}{C}}=CH–CH_3$ (iv) $CH_2=CH–NO_2$

Select the correct answer

(a) iv, i, ii, iii (b) iii, ii, i, iv (c) ii, iii, i, iv (d) ii, iii, iv, i

72. Which among the following compounds will give electrophilic addition reaction?

(i) $CH_2=CH_2$ (ii) $CH_3–C\equiv CH$

(iii) $CH_2=CH–CH=CH_2$ (iv) 

Select the correct answer

(a) i, ii and iii (b) i and ii (c) i, ii and iv (d) i, ii, iii and iv

73. In which compound addition reaction will take place according to anti-Morkonikov's rule?

(i) CH_2=CH–NO_2 (ii) CH_2=CH–CHO (iii) CH_2=CH–CN (iv) CH_3–CH=CH_2

Select the correct anwer

(a) i, ii and iii (b) i, ii and iv (c) i and ii (d) i and iii

74. For electrophilic addition with HCl, which pair is correctly matched?

(i) CH_3–CH=CH_2, alkyl carbocation

(ii) CH_3–CH≡CH, vinyl carbocation

(iii) CH_2=CH–CH=CH_2, allyl carbocation

(iv) C_6H_5–CH=C$\begin{matrix}\diagup CH_3 \\ \diagdown CH_3\end{matrix}$, alkyl carbocation

Select the correct answer

(a) i, iii and iv (b) ii, iii and iv (c) i, ii and iii (d) i, ii and iv

75. Consider the following statements

(i) Alkene is more reactive than alkyne for electrophilic addition reaction.

(ii) Alkyne gives nucleophilic as well as electrophilic addition reaction.

(iii) Alkyne is more reactive than alkene for nucleophilic addition reaction.

(iv) For electrophilic addition reaction, RI of alkyne is alkyl carbocation.

Of these, the correct statements are

(a) Only i (b) i and ii (c) i, ii and iv (d) i, ii and iii

76. Consider the following statements

(i) Conjugated diene gives direct as well as conjugate addition.

(ii) Conjugated diene gives only direct addition.

(iii) Conjugated diene gives only conjugate addition.

(iv) Thermodynamically controlled product is obtained by less stable reaction intermediate.

Of these, the correct statements are

(a) Only i (b) i and iv (c) ii and iii (d) Only iii

77. Consider the following statements

(i) Conjugated diene gives i, 2 and i, 4 adduct.

(ii) Conjugated diene gives kinetically and thermodynamically controlled product.

(iii) Formation of kinetically controlled product takes place by formation of stable RI.

(iv) Formation of thermodynamically controlled product takes place by the formation of stable RI.

Of these, the correct statements are

(a) i, ii and iii (b) i, ii and iv (c) Only i (d) Only iv

78. Which among the following reagents give syn addition with alkenes?

(i) Br_2 (ii) dil. $KMnO_4/OH^-$

(iii) $OsO_4/NaSO_3H/HOH$ (iv) $H_2/Ni/\Delta$

Select the correct answer

(a) Only i (b) ii and iii (c) ii, iii and iv (d) Only iv

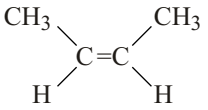
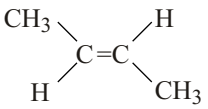
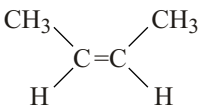
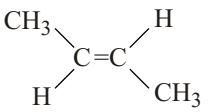
79. Match List i (reaction) with List ii (reagent) and select the correct answer from the codes given below

List I	List II
(a) $CH_3–CH=CH_2 \longrightarrow CH_3–CH_2–CH_2–OH$	(i) $Na/NH_3(l)$
(b) $CH_3–CH=CH_2 \longrightarrow CH_3–\underset{\displaystyle OH}{\underset{\vert}{CH}}–CH_3$	(ii) (i) BH_3 (ii) $H_2O_2/\overset{\ominus}{O}H$
(c) $CH_3–C\equiv C–CH_3 \longrightarrow$ trans-2-butene	(iii) Ni_2B
(d) $CH_3–C\equiv C–CH_3 \longrightarrow$ cis-2-butene	(iv) (i) Conc. H_2SO_4 (ii) HOH

	a	b	c	d
(a)	iv	ii	i	iii
(c)	ii	iv	i	iii

	a	b	c	d
(b)	iv	ii	iii	i
(d)	ii	iv	iii	i

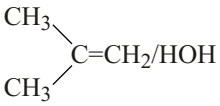
80. Match List I (substrate/reagent) with List II (product) and select the correct answer

List I	List II
(a)  + Br_2	(i) (±) 2,3-dibromobutane
(b)  + Br_2	(ii) (±) 2,3-butanediol
(c)  + Baeyer reagent	(iii) Meso-2,3-dibromobutane
(d)  + Baeyer reagent	(iv) Meso-2,3-butanediol

	a	b	c	d
(a)	iii	i	iv	ii
(c)	i	iii	ii	iv

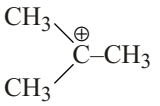
	a	b	c	d
(b)	i	iii	iv	ii
(d)	iii	i	ii	iv

81. Match List I (substrate/reagent) with List II (RI of the reaction) and select the correct answer

List I	List II
(a) $C_6H_5–CH=CH–CH_3/HCl$	(i) $CH_3–CH_2–\overset{\oplus}{C}H–CH=CH_2$
(b) 	(ii) $CH_3–\overset{\oplus}{C}H–CH_2–CH=CH_2$
(c) $CH_3–C\equiv CH/HCl$	(iii) $C_6H_5–\overset{\oplus}{C}H–CH_2–CH_3$

(d) $CH_3–CH=CH–CH=CH_2/HCl$

(iv) $C_6H_5–\overset{\oplus}{C}=CH_2$

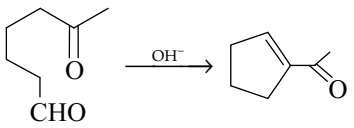
(v) 

	a	b	c	d
(a)	iii	v	iv	i
(c)	v	iii	iv	i

	a	b	c	d
(b)	iii	v	iv	ii
(d)	v	iii	i	iv

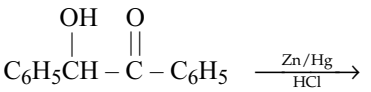
82. Which of the following reagent reacts in different ways with CH_3CHO, HCHO and C_6H_5CHO?

(a) Fehling solution (b) $C_6H_5NHNH_2$ (c) Ammonia (d) HCl

83. The reaction  is an example of

(a) Oxidation reaction (b) Reduction

(c) Both (d) Aldol condensation

84.  P. Here, P should be

(a) 

(b) 

(c) $C_6H_5CH_2CH_2C_6H_5$ (d) $C_6H_5CH=CHC_6H_5$

85. Nitrobenzene can be reduced to aniline by

(i) H_2/Ni (ii) Sn/HCl (iii) Zn/NaOH (iv) $LiAlH_4$

(a) i, ii and iii (b) i and ii (c) i, ii and iv (d) only ii

86. 1-methylcyclopentene can be converted into 2-methylcyclohexanol by

(a) acid-catalysed hydration

(b) hydroboration oxidation

(c) epoxide formation followed by reduction with $LiAlH_4$

(d) oxymercuration-demercuration

87. 2-methylpropanol-2 can be obtained by the acid-catalysed hydration of

(a) $CH_3CH_2CH=CH_2$ (b) $CH_3CH=CHCH_3$

(c) $(CH_3)_2C=CHCH_3$ (d) either of the three

88. Predict the nature of P in the following reaction: $CH_3C\equiv CCH_3 \xrightarrow[\text{heat}]{NaNH_2/\text{inert solvent}} P$

(a) $CH_2=CHCH=CH_2$ (b) $CH_2=C=CH–CH_3$

(c) $CH_3CH_2C\equiv CH$ (d) No reaction

89. Arrange the following alcohols in order of increasing ease of dehydration

CH_3CH_2OH $C_6H_5CH_2OH$ Cl_3CCH_2OH F_3CCH_2OH

i ii iii iv

(a) ii < i < iv < iii (b) iv < iii < ii < i (c) iv < iii < i < ii (d) ii < i < iii < iv

90. Which of the following statements are true?

(i) Structural isomers are compounds with the same molecular formula, but are different in the connectivity (order of attachment) of their atoms.

(ii) Stereoisomers are compounds with the same molecular formula and same order of attachment of their atoms, but are different in the orientation of their atoms or groups in space.

(iii) Enantiomers are stereoisomers whose molecules are mirror images of each other.

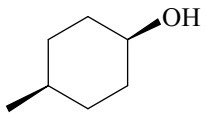
(iv) Diastereomers are stereoisomers whose molecules are not mirror images of each other.

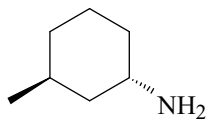
(v) A molecule with two chiral centres designated as (R,R) will have an enantiomer with two chiral centres designated as (S,R).

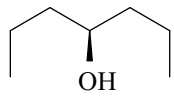
(vi) Cis-1,2-dichlorocyclopentane and trans-1,2-dichlorocyclopentane are enantiomer to each other.

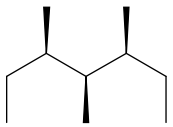
(a) i, ii, iv, vi (b) i, ii, iii, iv (c) i, ii, iii, iv, vi (d) ii, iii, iv, vi

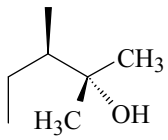
91. Which of the following are chiral molecules?

(i) 

(ii) 

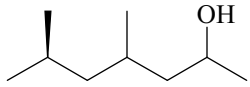
(iii) 

(iv) 

(v) 

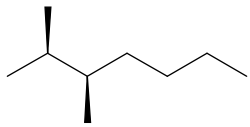
(a) ii (b) i, ii, iv (c) ii, v (d) ii, iv, v

92. How many stereoisomers are possible for the following compound?



(a) 2 (b) 3 (c) 4 (d) 8

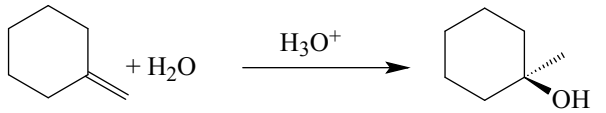
93. What is the name of the following compound?



(a) (2R,3S)-2,3-dimethylhexane (b) (R)-2,3-dimethylhexane

(c) (S)-2,3-dimethylhexane (d) (2S,3R)-2,3-dimethylhexane

94. What is the role of H_3O^+ in this reaction?



(a) Base (b) Nucleophile (c) Catalyst (d) Leaving group

95. Which statements are true for S_N2 reaction of alkyl halides?

i: Both of the alkyl halide and nucleophile are involved in the transition state.

ii: Reaction proceeds with inversion of configuration at the substitution centre.

iii: Reaction proceeds with retention of configuration at the substitution centre.

iv: The order of reactivity is $3^o > 2^o > 1^o$.

v: The nucleophile must have an unshared electron pair and bears a negative charge.

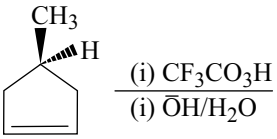
vi: The greater the nucleophilicity of the nucleophile, the greater the rate of reaction.

(a) i, ii, iv, v (b) i, ii, v, vi (c) i, iii, v, vi (d) i, ii, vi

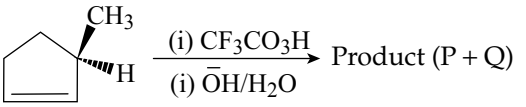
Comprehension Type

Passage 1

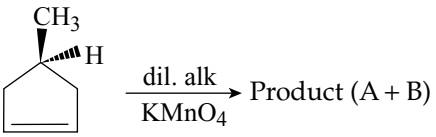
In the given reactions

(i) 

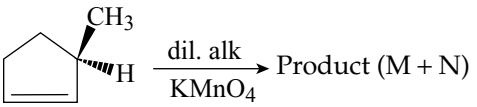
Product (X + Y)

(ii) 

Product (P + Q)

(iii) 

Product (A + B)

(iv) 

Product (M + N)

96. For the given reaction (i), X and Y are

(a) Meso compound (b) Diastereomers

(c) Identical (d) Enantiomers

97. For the given reaction (iv), products M and N are

(a) Enantiomers (b) Diastereomers (c) Identical (d) Meso compound

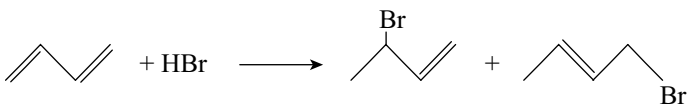
98. Which of the following is a correct statement?

(a) Products A and B are Diastereo Isomers (b) Products P and Q are enantiomers

(c) Products A and B are identical (d) Products P and Q are identical

Passage 2

The reaction of 1, 3-butadiene with HBr is shown below. At 40°C the major product is the 1, 4-addition product; however, at –80°C the major product is the 1, 2-addition product.



99. Thermodynamically controlled product is

(a) 1, 2-addition product (b) 1, 4-addition product

(c) The products have same stability (d) cannot be determined

100. Why are two products formed?

(a) The carbocation intermediate allows delocalisation of the second double bond.

(b) There are two double bonds present.

(c) The fact that the carbocation is planar allows attack from both sides of the plane.

(d) There are 2 moles of HBr.

101. Which of the two products has a lower activation energy for formation?

(a) 1, 4-addition product.

(b) 1, 2-addition product.

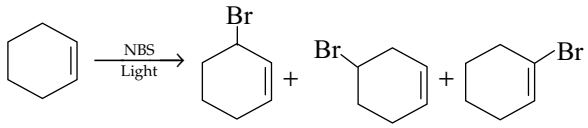
(c) The products have same activation energy.

(d) The relative activation energy cannot be determined.

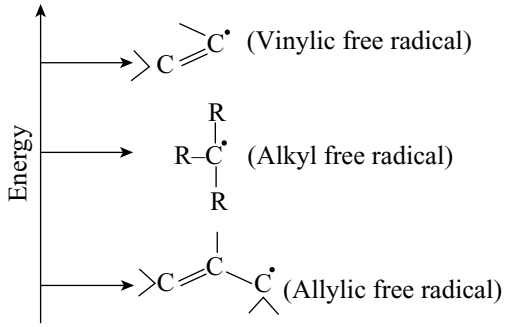
Passage 3

Karl Ziegler reported that alkenes react with N-bromosuccinimide (NBS) in the presence of light to give products resulting from substitution of hydrogen by bromine at the allylic position, i.e., the position next to the double bond.

Let us consider the halogenation of cyclohexene

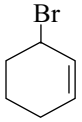


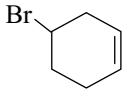
Energy level diagram for allylic, vinylic and alkylic free radicals is given

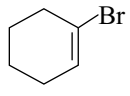


Answer the following questions

102. In the treatment of cyclohexene with NBS, which of the following products will be formed?

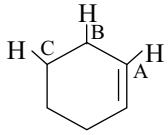
(a) 

(b) 

(c) 

(d) cannot be predicted

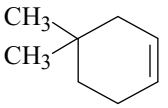
103. Consider the three types of C—H bonds in cyclohexene



Which of the following is/are correctly matched?

(a) A-Vinylic C–H bond (b) B-Allylic C–H bond

(c) C-Alkylic C–H bond (d) All of these

104. 

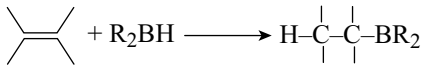
(4, 4-dimethyl cyclohexene)

Above compound on treatment with NBS gives allylic bromides. How many product(s) will be obtained in this reaction (neglecting stereoisomers)?

(a) One (b) Two (c) Three (d) Four

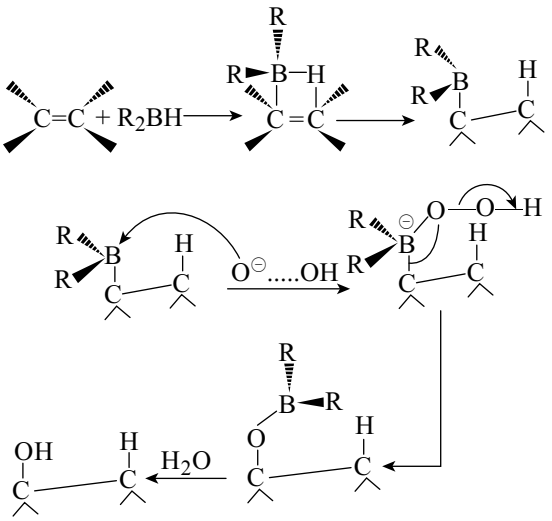
Passage 4

Hydroboration is a reaction in which boron hydride acts as an electrophile. R_2BH adds to a carbon–carbon double bond which acts as a nucleophile

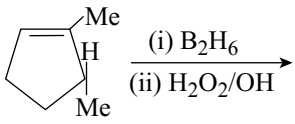
i.e., 

Organoborane compound

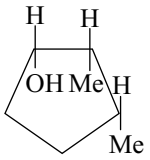
The organoborane compound then is oxidised by treatment with hydrogen peroxide in aqueous medium to form alcohol. The OH-group enters the carbon atom from the same side where the boron atom was present.

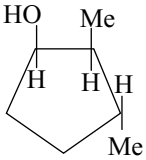


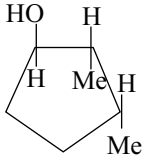
Hence this reaction is highly regioselective and the boron atom attaches to that carbon atom which is less stearically hindered.

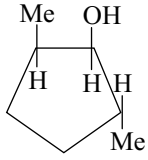
105. 

A; Hence, compound A is

(a) 

(b) 

(c) 

(d) 

106. $R–CH=CH_2 \xrightarrow{NOCl} X$; Hence, X is

(a) $R–\underset{\underset{NO}{|}}{CH}–Cl$ (b) $R–\underset{\underset{NO}{|}}{CH}–CH_2–Cl$ (c) $R–CHO + CH_2Cl_2$ (d) $R–\underset{\underset{Cl}{|}}{CH}–CH_2–NO$

107. $R–CH = CH_2 + CO + H_2 \xrightarrow{[Co_2(CO)_8]} A$; Hence, A is

(a) $R–CH_2CH_2CHO$ (b) $R–\underset{\underset{CHO}{|}}{CH}–CH_3$

(c) R–CH=CH–CHO (d) Both (a) and (b)

Passage 5

Compound having atleast one π-bond gives addition reaction. Alkene behaves as a nucleophile and hence it gives an electrophilic addition reaction. Electrophilic addition reaction in most of the cases takes place by formation of carbocation as reaction intermediate.

108. Which one of the following is NOT correct for electrophilic addition of alkenes?

(a) In the first step, alkene reacts with electrophile to form a π-complex.

(b) π-complex converts into carbocation and the step is a rate-determining step.

(c) Product formation takes place by formation of most stable reaction intermediate.

(d) Rearrange product is not formed in addition reaction with HBr.

109. Consider the following statements

(i) Unsymmetrical alkene gives addition product according to Markovnikov's rule.

(ii) Addition reaction is a regioselective reaction.

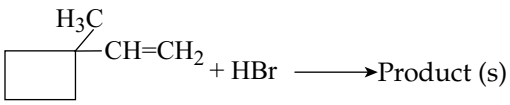
(iii) Rearranged product is formed in addition reaction.

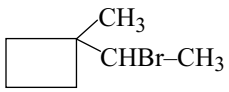
(iv) Alkene gives mixed addition product with $NaCl/HOH/H^+$.

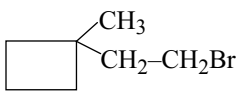
Which one is/are correct?

(a) i, ii, iii and iv (b) ii, iii and iv (c) i, iii and iv (d) i, ii and iv

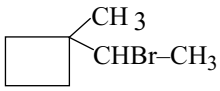
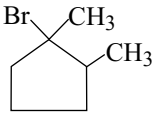
110. In the given reaction



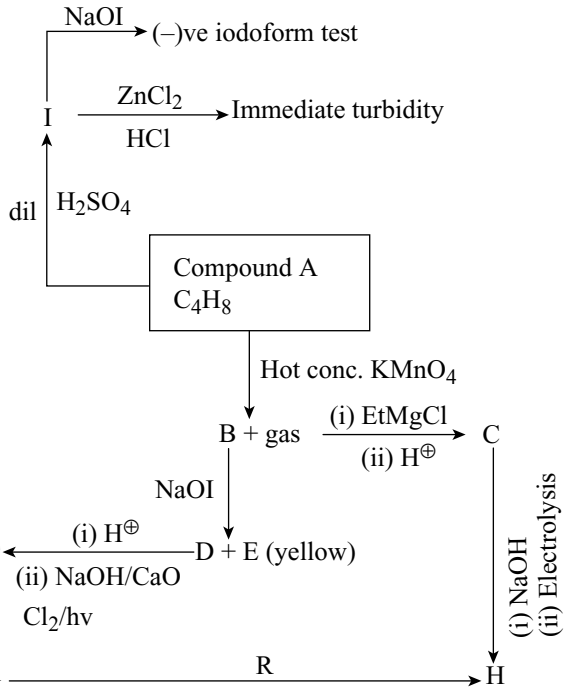
(a) 

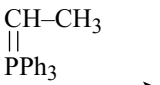
(b) 

(c) Mixture of (A) and (B)

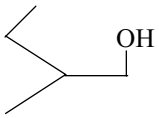
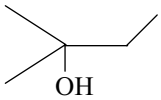
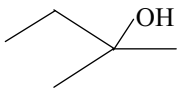
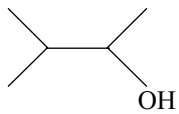
(d) Mixture of  and 

Passage 6



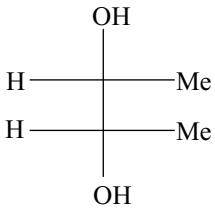
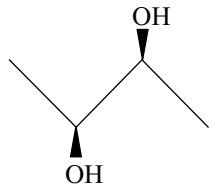
111. Compound B  X-compound $\xrightarrow[(2)\ NaOH/H_2O_2]{(1)\ B_2H_6-THF}$ Y-compound

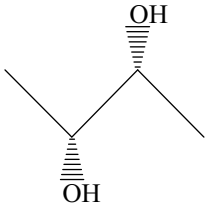
Identify structure of compound Y

(a)  (b)  (c)  (d) 

112. (Compound E) $\xrightarrow{Ag/\Delta}$ Comp. 1 $\xrightarrow[(2)\ 2eq.CH_3I]{(1)\ 2eq.NaNH_2}$ Comp. 2 $\xrightarrow[H_2]{Pb/BaSO_4}$ Comp. 3 $\xrightarrow[(2)\ NaHSO_3\ (Aqueous)]{(1)\ OsO_4}$ Comp. 4

Identify stereochemistry compound 4

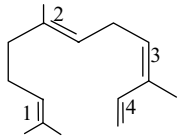
(a)  (b) 

(c) 

(d) (B) and (C) both

Passage 7

A terpene that is contained in the oil of citronella is α-farnesene. Refer to the structure of α-farnesene to answer the following questions.

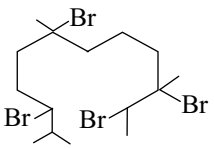


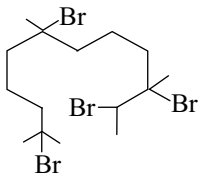
113. What reaction conditions could be used to produce acetone from α-farnesene?

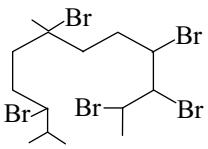
(a) H_2SO_4 and heat (b) HBr

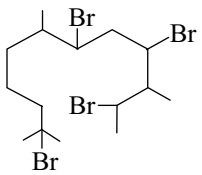
(c) O_3 and $(CH_3)_2S$ (d) dil. acid and cold conditions

114. If α-farnesene is reacted with an excess HBr, what would be the product?

(a) 

(b) 

(c) 

(d) 

115. In the reaction of α-farnesene with excess HBr, which double bond would be slowest to react?

(a) The bond labelled 1 (b) The bond labelled 2

(c) The bond labelled 3 (d) The bond labelled 4

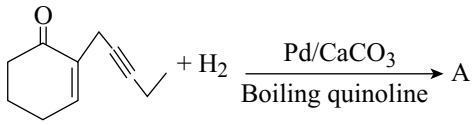
Passage 8

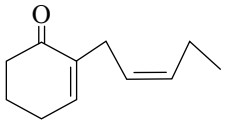
Hydrogenation of alkenes and alkynes takes place in the presence of certain catalysts. In Sabatier Senderen's reaction, the addition of hydrogen takes place in the presence of Raney nickel catalyst. Platinum and palladium can also be used as catalysts in these reactions. These are heterogeneous catalysts and used in finely divided state. Experimentally, it is observed that less crowded alkenes adsorb H_2 with faster rate. Controlled hydrogenation of alkyne in the presence of Lindlar's catalyst yields cis product, i.e., "cis" alkene. Thus, in the presence of Lindlar's catalyst "syn" addition takes place. The relative rate of hydrogenation follows the order

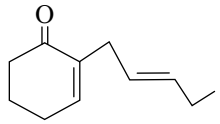
$$—C\equiv C— > > C=C < > > C=O > C_6H_6$$

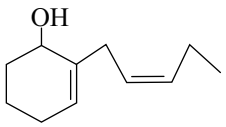
Non-terminal alkynes are reduced in the presence of Na or Li metal dissolved in liquid ammonia. In this reaction, anti addition of hydrogen results into the trans-product.

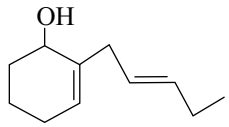
116. The product of the following reaction is

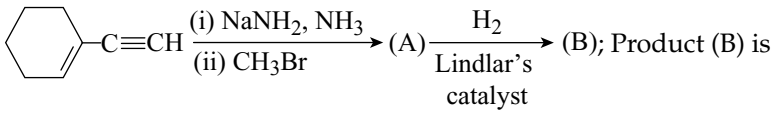


(a) 

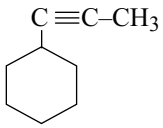
(b) 

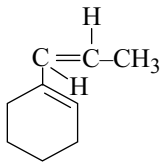
(c) 

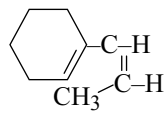
(d) 

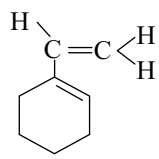
117. 

(B); Product (B) is

(a) 

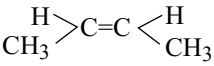
(b) 

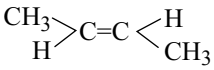
(c) 

(d) 

118. $CH_3–C\equiv C–CH_3 + H_2 \xrightarrow[\text{Boiling quinoline}]{Pd/CaCO_3}$ (A); The product (A) will be

(a) $CH_3CH_2CH_2CH_3$

(b) 

(c) 

(d) $CH_3–CH_2–CH=CH_2$

Passage 9

The structure of alkyne is linear. Terminal alkyne is acidic in character. It reacts with base to give acid–base reaction. Alkyne is nucleophile and gives electrophilic as well as nucleophilic addition reaction.

119. Which one of the following compounds forms carbonyl production reaction with 1% $HgSO_4$ + dil.H_2SO_4?

(a) $CH_2 = CH_2$ (b) $CH_3 – C \equiv C – C_6H_5$

(c) $CH_3 – C \equiv C – CH_3$ (d) Cyclohexene

120. Terminal alkyne will react with which of the following?

(a) Tollen's reagent (b) Sia_2BH/THE

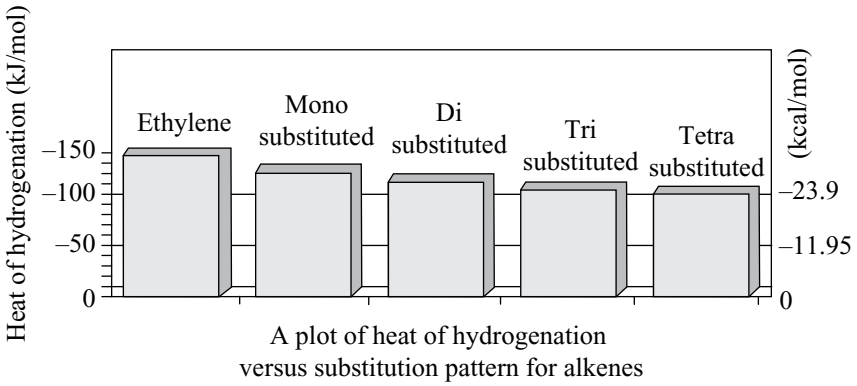
(c) $H_2O/HgSO_4/H_2SO_4$(d) All of these

121. Which one of the following will react with $NaNH_2$?

(a) $CH_3 – CH_3$ (b) $CH_2 = CH_2$ (c) $CH_3 – C \equiv CH$ (d) $CH_3 – C \equiv C – CH_3$

Passage 10

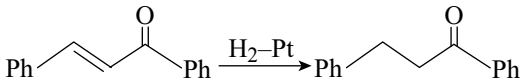
Following figure is given to test analytical ability. Based on it, answer the questions at the end of it.



A plot of heat of hydrogenation versus substitution pattern for alkenes

Catalytic hydrogenation is usually a stereospecific reaction called syn addition.

- The C≡C bond is reduced more readily than C=C but other unsaturated groups (except nitro and acid chlorides) are reduced less readily. Catalytic hydrogenation can, therefore, be used for the selective reduction of C=C in the presence of aromatic rings and carbonyl groups, whether or not the unsaturated functions are conjugated.

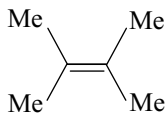


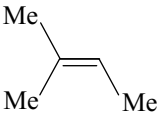
The rate of hydrogenation of olefinic bonds under standard state is

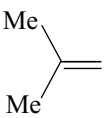
$$-CH=CH_2 > -CH=CH-$$

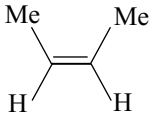
or a ring double bond

122. Base on the data of heat of hydrogenation, which has maximum stability?

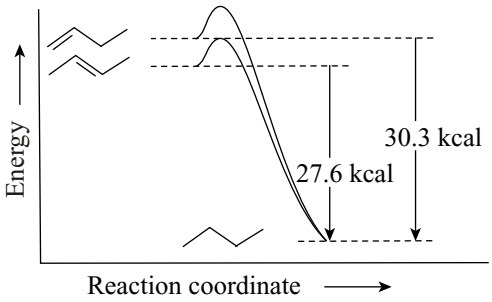
(a) 

(b) 

(c) 

(d) 

123. Consider following graph



From this, it is clear that

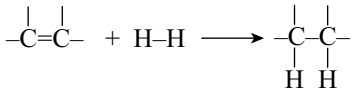
(a) cis-2-butene is more stable than 1-butene by 2.7 kcal

(b) trans-2-butene is more stable than 1-butene by 2.7 kcal

(c) trans-2-butene is more stable than cis-2-butene by 11 kJ

(d) trans-2-butene is more stable than 1-butene by 11 kJ

124. Bond energies (in kcal mol^{-1}) of different types of bonds have been given as >C=C< (π bond=40); H–H=(104) and >C–H=(87).



Heat of hydrogenation of the above reaction is

(a) 57 kcal mol^{-1} (b) –57 kcal mol^{-1} (c) –30 kcal mol^{-1} (d) 30 kcal mol^{-1}

Passage 11

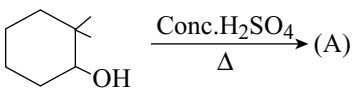
Strictly speaking, then, dehydration is not an E1 reaction of the protonated alcohol. In a true E1 elimination, the rate of reaction depends only upon heterolysis step, since every carbocation formed goes rapidly on to the product, that is, loss of a proton is much faster than regeneration of substrate. Here that is not the case for carbocations are formed reversibly from the protonated alcohol, and every so often one looses a proton to yield an alkene. Where the structure of alkyl group permits, rearrangement takes place. The initially formed carbocation rearranges to a more stable carbocation. The alkenes obtained are those formed by a loss of proton from this rearranged carbocation as well as from the original one.

When more than one alkene can be formed the preferred product is the more stable one. Another factor comes in here. Since dehydration is reversible, the composition of the product does not necessarily reflect which alkene is formed faster but depending upon how nearly reaction approaches equilibrium which alkene is more stable.

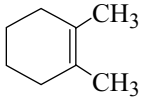
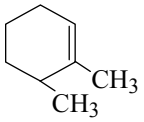
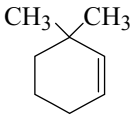
125. When neopentyl alcohol, $(CH_3)_3C\,CH_2OH$ is heated with an acid, it is slowly converted to a 85:15 mixture of two alkenes of formula C_5H_{10}. The 85% of these alkene is

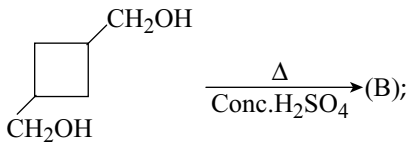
(a) $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH_2$ (b) $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}–CH=CH_2$

(c) $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH–CH_3$ (d) $CH_2=\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}–CH_2–CH_3$

126. 

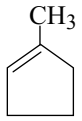
The product (A) is

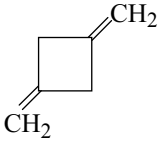
(a)  (b)  (c)  (d) None

127. 

The product (B) is

(a) 

(b) 

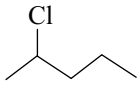
(c) 

(d) None

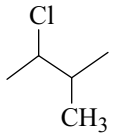
Passage 12

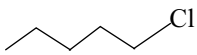
An organic compound A($C_5H_{11}Cl$) is optically active and on treatment with ethanolic KOH solution yields B(C_5H_{10}) as a major product, which does not show stereoisomerism. Also A on treatment with $(CH_3)_2CuLi$ yields C(C_6H_{14}), which is optically inactive. Deduce structures of A to C.

128. Identify structure of "A" compound

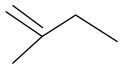
(a) 

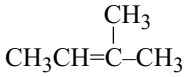
(b) 

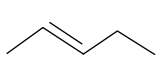
(c) 

(d) 

129. Identify structure of "B" compound

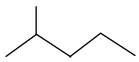
(a) 

(b) 

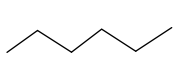
(c) 

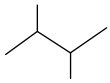
(d) 

130. Identify structure of "C" compound

(a) 

(b) 

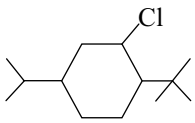
(c) 

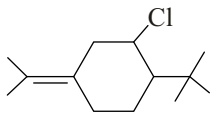
(d) 

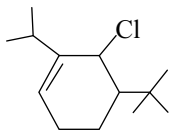
Passage 13

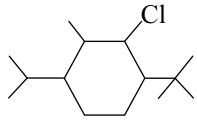
An organic compound A($C_{13}H_{23}Cl$) exists as distereomers and decolourise bromine water. A on treatment with ethanolic solution of KOH produces isomeric B and C with their molecular formula $C_{13}H_{22}$. Treatment of either B or C with Rany Nickel produces 4-isopropyl-1-tertiarybutyl cyclohexane. A on oxidative ozonolysis gives acetone as one product. Identify A, B and C considering C to be enantiomeric.

131. According to the information given in the above paragraph compound (A) will be

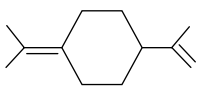
(a) 

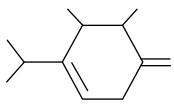
(b) 

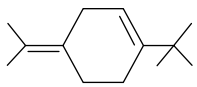
(c) 

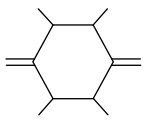
(d) 

132. According to the information given in the above paragraph compound (B) will be

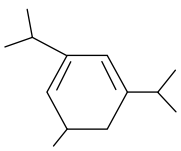
(a) 

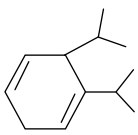
(b) 

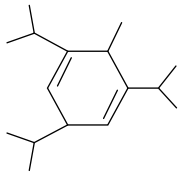
(c) 

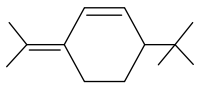
(d) 

133. According to the information given in the above paragraph compound (C) will be

(a) 

(b) 

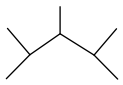
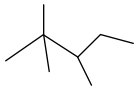
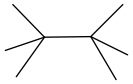
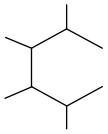
(c) 

(d) 

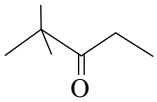
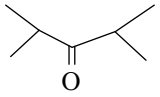
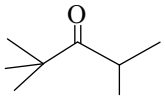
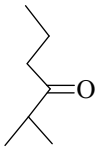
Passage 14

An optically active hydrocarbon A has molecular formula C_8H_{18}. A on monochlorination gives five alkyl halide B to F with their molecular formula $C_8H_{17}Cl$. B does not undergo dehydrohalogenation on treatment with alcoholic solution of KOH. Treatment of either C or D with alcoholic KOH yields same alkene G(C_8H_{16}), which on ozonolysis followed by work-up with Zn-dimethyl sulphide gives an optically inactive compound $C_6H_{12}O$ and ethanal. Also C is enantiomeric, whereas D is distereomeric. E on dehydrohalogenation yields an alkene, which on reductive ozonolysis yields H($C_7H_{14}O$), which is optically inactive. H on treatment with $LiAlH_4$ yields I($C_7H_{16}O$) which can be resolved into enantiomers. F on dehydrohalogenation yields an alkene (C_8H_{16}), which on reductive ozonolysis yields J($C_7H_{14}O$), which is optically active and has same configuration as that of A. Identify A to J explaining the reactions involved.

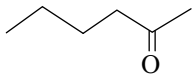
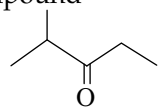
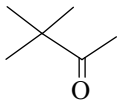
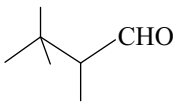
134. Identify structure of "A" compound

(a)  (b)  (c)  (d) 

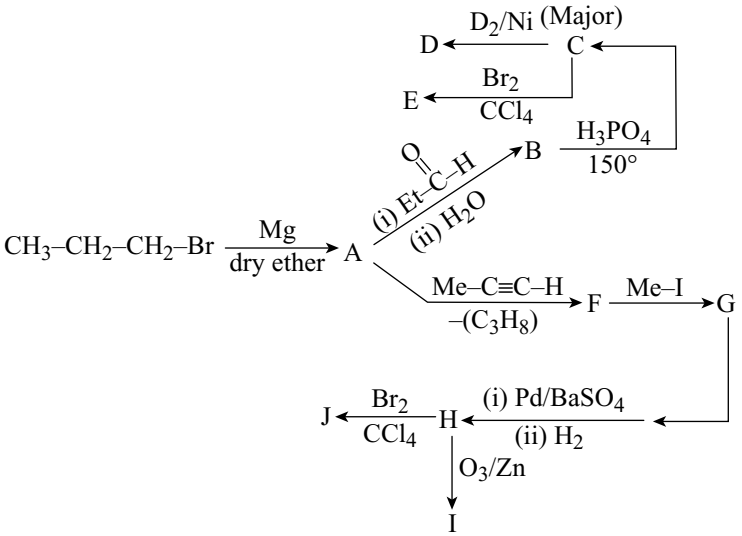
135. Identify structure of "H" compound

(a)  (b)  (c)  (d) 

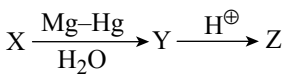
136. Identify structure of "J" compound

(a)  (b)  (c)  (d) 

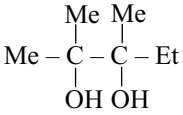
Passage 15

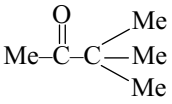


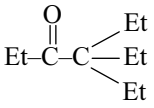
137. Identify "Z" compound

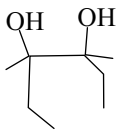


where X is a functional isomer of "W" which is next higher homologue of "I"

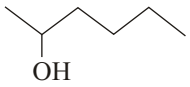
(a) 

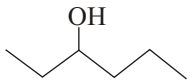
(b) 

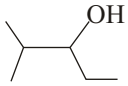
(c) 

(d) 

138. In the above reaction sequence "B" compound is

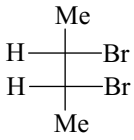
(a) 

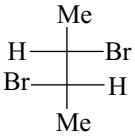
(b) 

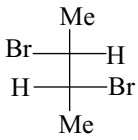
(c) 

(d) 

139. In the above reaction sequence "J" compound is

(a) 

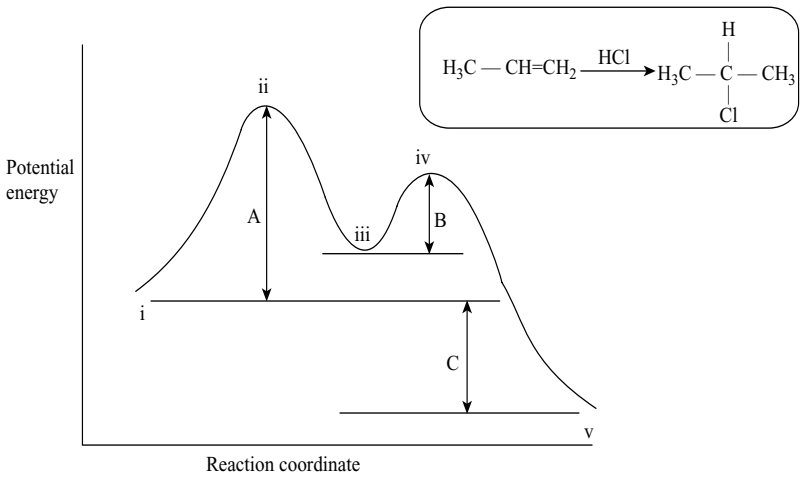
(b) 

(c) 

(d) both (b) and (c)

Passage 16

Based on the potential energy diagram for the following reaction



140. Is this an endothermic or exothermic reaction?

(a) Endothermic

(b) Exothermic

(c) There is not enough information to determine.

(d) This reaction can be either exothermic or endothermic.

141. What is B representing in this potential energy diagram?

(a) heat of reaction: the energy required for the reaction to occur

(b) heat of reaction: the overall energy change for this reaction

(c) activation energy: the energy required for the reaction to occur

(d) activation energy: the overall energy change for this reaction

142. What is C representing in this potential energy diagram?

(a) heat of reaction: the energy required for the reaction to occur

(b) heat of reaction: the overall energy change for this reaction

(d) activation energy: the energy required for the reaction to occur

(d) activation energy: the overall energy change for this reaction

143. What is ii representing in this potential energy diagram?

(a) transition state (b) intermediate

(c) activation energy (d) heat of reaction

144. What is iii representing in this potential energy diagram?

(a) transition state (b) intermediate

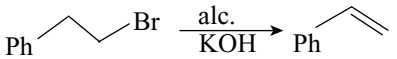
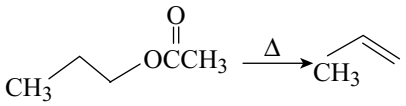
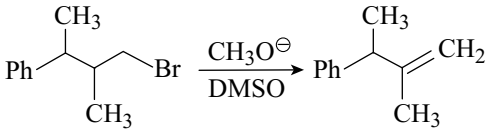
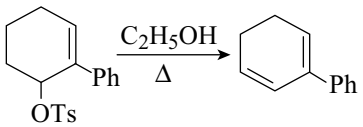
(c) activation energy (d) heat of reaction

145. Which step is the rate-determining (rate-limiting) step?

(a) from i to v (b) from i to iii (c) from ii to iii (d) from iii to v

Matrix Type

146.

Column I (Reaction)	**Column II (Type of reaction)**
(a) 	(p) $\mathbf{E_1}$
(b) 	(q) $\mathbf{E_2}$
(c) 	(r) $\mathbf{E_{1CB}}$
(d) 	(s) $\mathbf{E_i}$

147.

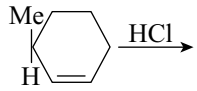
Column I	**Column II (Type of reaction)**
(a) $(CH_3)_3C—Br$	(p) E_1 CB
(b) $CH_3–\underset{\displaystyle Cl}{\underset{\vert}{CH}}–CH_3$	(q) First-order kinetics
(c) $CH_3–CH_2–\underset{\displaystyle Br}{\underset{\vert}{CH}}–CH_3$	(r) E_1
(d) $C_6H_5–CH_2–\underset{\displaystyle F}{\underset{\vert}{CH}}–CH_3$	(s) E_2

148. **Column I** **Column II**

(a) $CH_2=CH-COOH+HBr$ (p) Nonregioselective

(b) cis $CH_3-CH=CH-C_2H_5+KMnO_4$(cold alk.) (q) Trans addition

(c) cis $CH_3-CH=CH-CH_3+X_2 \xrightarrow{CS_2}$ (r) Primary carbocation

(d)  (s) Optically active

149. **Column I (Reaction)** **Column II (Reagent)**

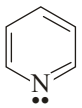
(a) $(CH_3)_3C-CH=CH_2 \longrightarrow (H_3C)_2C(OH)-CH(CH_3)_2$ (p) $B_2H_6/H_2O_2/OH^-$

(b) $(CH_3)_3C-CH=CH_2 \longrightarrow (CH_3)_3C-CH(OH)-CH_3$ (q) $H_2O/H^+/MnO_2$

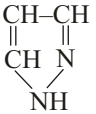
(c) $H_5C_6-CH=CH_2 \longrightarrow C_6H_5-CHO$ (r) $Hg(OAc)_2/H_2O/NaBH_4$

(d) $C_6H_5-C\equiv CH \longrightarrow C_6H_5-CH_2-CHO$ (s) H_2O/H^+

150. **Column I** **Column II**

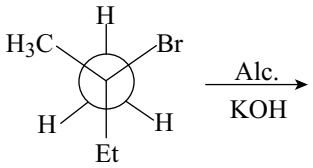
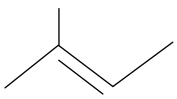
(a) $HC\equiv CH \longrightarrow$  (p) O_3/H_2O

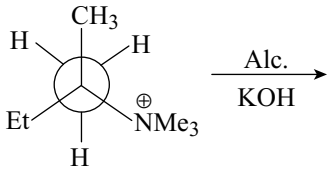
(b) $H_5C_2-C\equiv C-C_2H_5 \longrightarrow H_5C_2-C(=O)-CH_2-C_2H_5$ (q) CH_2N_2 (cold ether solution)

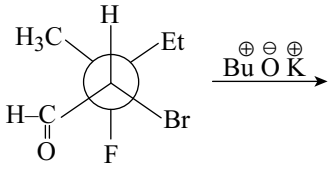
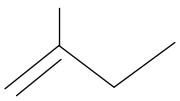
(c) $HC\equiv CH \longrightarrow$  (r) HCN (Red hot Fe)

(d) $H_5C_2-C\equiv C-C_2H_5 \longrightarrow 2H_5C_2-COOH$ (s) $H_2O/H_2SO_4/HgSO_4$

151. **Column I** **Column II**

(a)  (p) 

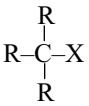
(b)  (q) E^2

(c)  (r) 

(s) E^1CB

152. **Column I** **Column II**

(a) $R–CH_2–X$ (p) Corey-house reaction

(b)  (q) Kolbe electrolysis

(c) $CH_2=CH–X$ (r) Wurtz reaction

(d) $R–COO^- Na^{\oplus}$ (s) Frankland reaction

153. **Column I** **Column II**

(a) But-1-yne (p) Reacts with $KMnO_4/KOH$ to give acetic acid

(b) But-2-yne (q) With Hg^{2+}/H_2SO_4 gives butan-2-one

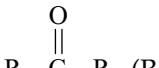
(c) Benzene (r) Reacts with CH_3Cl to form but-2-yne

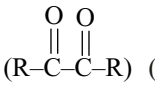
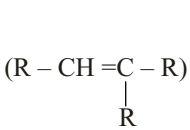
(d) $CH_3C\equiv CNa$ (s) Reacts with $O_3/Zn/H_2O$ to give glyoxal

154. **Column I** **Column II**

(a) Oxidative ozonolysis of alkene (p) R–CHO (R–C≡C–R)

(b) Oxidative ozonolysis of alkyne (q) R–COOH (R–CH=CH–R)

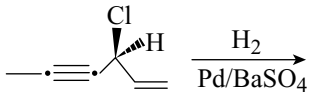
(c) Reductive ozonolysis of alkene (r)  (R–C≡C–R)

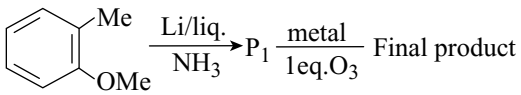
(d) Reductive ozonolysis of alkyne (s)  

155. **Column I** **Column II**

(a) $Me-C\equiv C-Me \xrightarrow[\text{liq. } NH_3]{Na} P_1 \xrightarrow[CCl_4]{Br_2}$ Final product (p) Final product of reaction is racemic mixture.

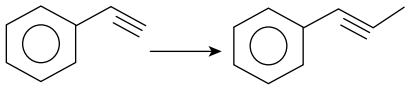
(b) $Et-C\equiv C-Et \xrightarrow[\text{liq. } NH_3]{Na} P_1 \xrightarrow[Ni]{D_2}$ Final product (q) Final product of reaction is meso.

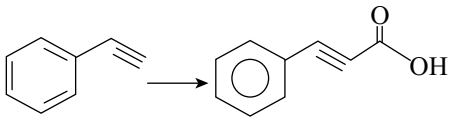
(c)  (r) Net optical rotation of final product is zero.

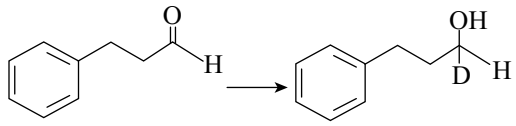
(d)  (s) Net optical rotation of final product is nonzero.

(t) Final product has one asymmetric carbon atom.

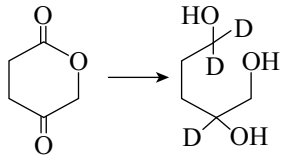
156. **Column I** **Column II**

(a)  (p) $NaBD_4/EtOH$

(b)  (q) $LiAlD_4$/dil. HCl

(c) 

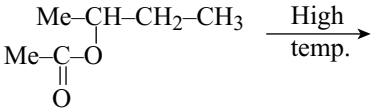
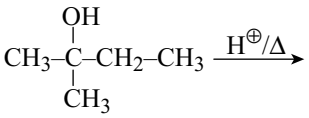
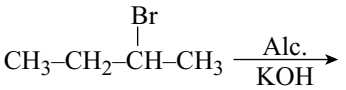
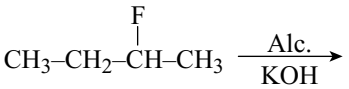
(r) $C_2H_5MgBr/CO_2/H_3O^+$

(d) 

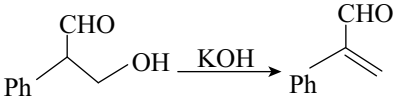
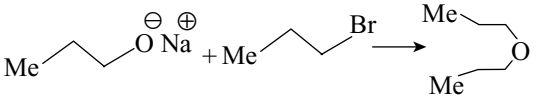
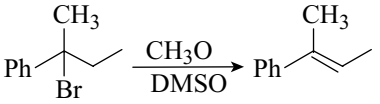
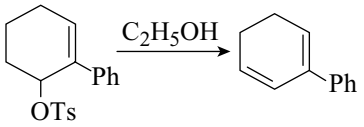
(s) $NaNH_2/liq.\ NH_3/CH_3–I$

(t) $CH_3MgBr/CH_3–I$

157.

Column I (Substrate for elimination reaction)	**Column II (Type of elimination)**
(a) 	(p) E1
(b) 	(q) E2
(c) 	(r) Ei/Pyrolysis
(d) 	(s) Saytzeff elimination
	(t) Hoffmann elimination

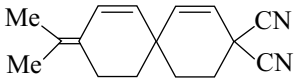
158.

Column I (reaction)	**Column II (type of reaction: Major)**
(a) 	(p) E_1
(b) 	(q) E_2
(c) 	(r) E_{1CB}
(d) 	(s) S_{N^2}

Integer Type

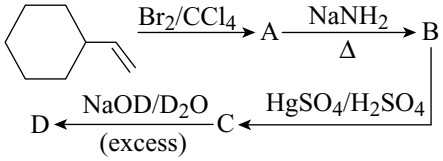
159. Number of hydrocarbons formed when C_2H_5Br and $CH_3–CH_2–CH_2–Br$ are treated with Na in the presence of dry ether is:

160. How many number of moles of H_2 is used for the complete hydrogenation of the given compound in the presence of a metal catalyst?



161. Number of different products formed by the ozonolysis of 1-4-butadiene is

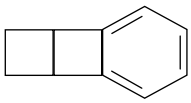
162. Consider the following reaction scheme



How many deutrium are present in the compound D?

163. What volume of ethane (NTP; 1 bar, 273 K) is formed from 38 g of sodium propionate by fusion with sode lime?

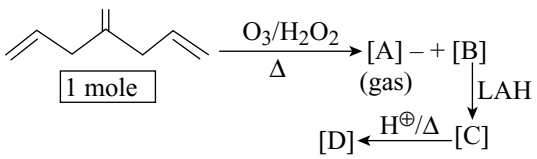
164. $(CH_3)_2C{=}CH(CH_3) \xrightarrow[H_2]{\text{Catalyst}}$ Optical isomers

165. Degree of unsaturation in  is

166. Minimum number of C-atoms in alkynes to show optical isomerism is

167. Number of products obtained on ozonolysis of 1, 2-dimethyl benzene is

168.



If X = Number of moles of CO_2

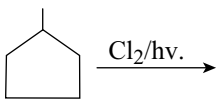
Y = Number of α–H in "D" compound

X + Y = Z

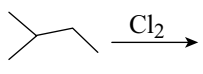
Identify value of "Z".

169. An optically active compound A has the molecular formula C_6H_{10}. The compound gives a precipitate when treated with $Ag(NH_3)_2OH$. On catalytic hydrogenation, A yields $B(C_6H_{14})$, which is optically inactive. Identify total number of "α" "H" in product formed by treatment of A with O_3/H_2O_2 then LAH and then $H^{\oplus}/\Delta$.

170. Consider the following reactions



Total number of monochlorinated product =
X (Excluding stereoisomers)



Total number of monochlorinated product =
X (Excluding stereoisomers)

Identify value of X + Y.

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	a	b	b	c	d	a	c	d	ab	a	c	b	b	b
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
c	c	b	d	a	a	d	d	c	b	d	cd	d	c	a
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
c	b	d	b	c	d	c	a	c	a	b	b	b	c	c
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	b	c	b	d	c	bd	c	b	c	d	b	acd	acd	ab
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	d	d	d	c	d	b	d	c	c	d	ac	b	abc	d
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
abcd	abcd	bd	abc	bc	a	a	ac	ab	abd	bc	bc	abcd	ad	abc
91	92	93	94	95	96	97	98	99	100					
ab	abc	ac	a	d	d	bd	abc	abcd	b					

LEVEL 2

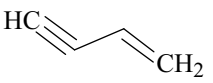
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	ac	c	d	d	d	a	ab	b	cd	ab	ab	d	d	d
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
abd	b	b	b	b	c	d	c	a	d	b	a	c	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
c	d	b	b	b	a	a	c	b	b	a	b	a	d	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	b	a	b	b	b	a	b	bc	c	ab	acd	bd	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
acd	ac	abd	ac	ac	bcd	abcd	b	bc	ab	b	a	a	c	d
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
a	a	c	c	b	a	a	d	b	b	b	c	c	c	b

91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
c	c	c	c	b	d	b	a	b	a	b	a	d	c	c
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
d	a	d	a	d	d	a	c	b	d	a	c	b	bc	d
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
c	a	b	b	c	a	a	c	b	d	b	c	d	b	a
136	137	138	139	140	141	142	143	144	145	146(a)	146(b)	146(c)	146(d)	147(a)
d	b	b	d	b	c	b	a	b	b	r	s	q	p	qrs
147(b)	147(c)	147(d)	148(a)	148(b)	148(c)	148(d)	149(a)	149(b)	149(c)	149(d)	150(a)	150(b)	150(c)	150(d)
qrs	qrs	p	r	ps	pqs	s	s	r	q	p	r	s	q	p
151(a)	151(b)	151(c)	152(a)	152(b)	152(c)	152(d)	153(a)	153(b)	153(c)	153(d)	154(a)	154(b)	154(c)	154(d)
pq	qr	s	prs	ps	pr	q	p	pq	s	pr	q	p	s	r
155(a)	155(b)	155(c)	155(d)	156(a)	156(b)	156(c)	156(d)	157(a)	157(b)	157(c)	157(d)	158(a)	158(b)	158(c)
qrt	prt	st	r	s	r	pq	q	rt	ps	qs	qt	r	s	q

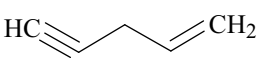
158(d)	159	160	161	162	163	164	165	166	167	168	169	170
p	7	7	2	4	10	0	6	6	3	11	9	8

WORKBOOK EXERCISES

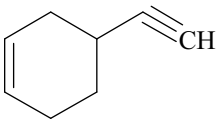
EXERCISE 1

1. 

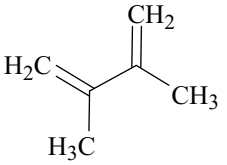
$\xrightarrow[CCl_4]{1eq\ HCl}$

2. 

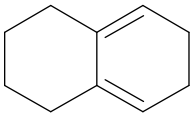
$\xrightarrow[CCl_4]{Excess\ HCl}$

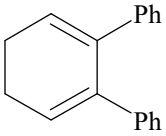
3. 

$\xrightarrow[CCl_4]{1eq\ HCl}$

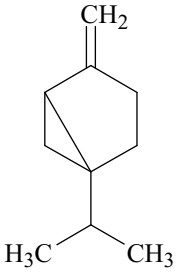
4. 

$\xrightarrow[CCl_4]{1eq\ HCl}$

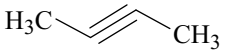
5. 
$\xrightarrow[CCl_4]{1eq\ HCl}$

6. 

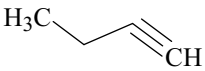
$\xrightarrow[CCl_4]{1eq\ HCl}$

7. 

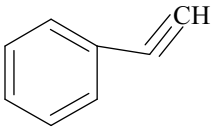
$\xrightarrow[CCl_4]{1eq\ HCl}$

8. 

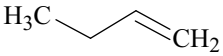
$\xrightarrow[CCl_4]{Excess\ HCl}$

9. 

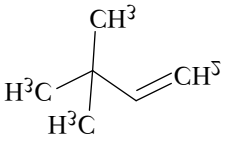
$\xrightarrow[CCl_4]{Excess\ HCl}$

10. 

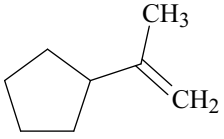
$\xrightarrow[CCl_4]{Excess\ HCl}$ A $\xrightarrow[CCl_4]{Excess\ NaOH}$ B

11. 

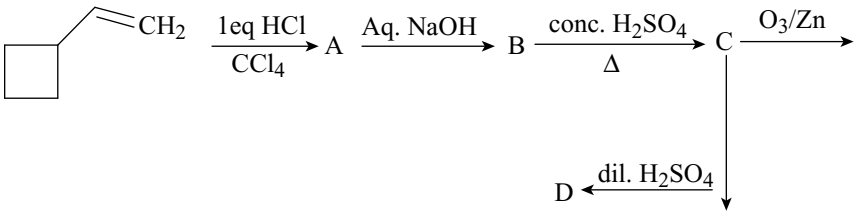
$\xrightarrow[CCl_4]{1eq\ HCl}$ A $\xrightarrow{Aq.\ NaOH}$ B $\xrightarrow[\Delta]{conc.\ H_2SO_4}$ C

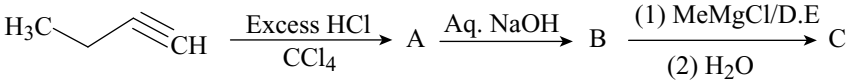
12. 

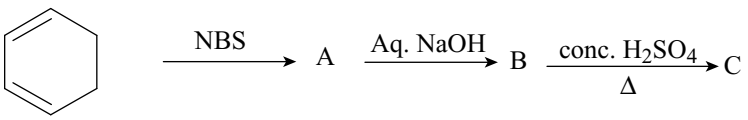
$\xrightarrow[CCl_4]{1eq\ HCl}$ A $\xrightarrow{Aq.\ NaOH}$ B $\xrightarrow[\Delta]{conc.\ H_2SO_4}$ C

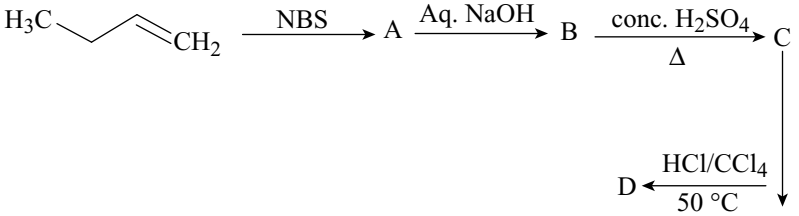
13. 

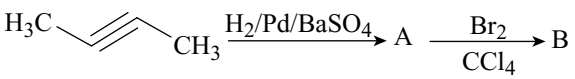
$\xrightarrow[CCl_4]{1eq\ HCl}$ A $\xrightarrow{Aq.\ NaOH}$ B $\xrightarrow[\Delta]{conc.\ H_2SO_4}$ C

14. 
CH2
1eq HCl
CCl4
A
Aq. NaOH
B
conc. H2SO4
Δ
C
O3/Zn
D
dil. H2SO4

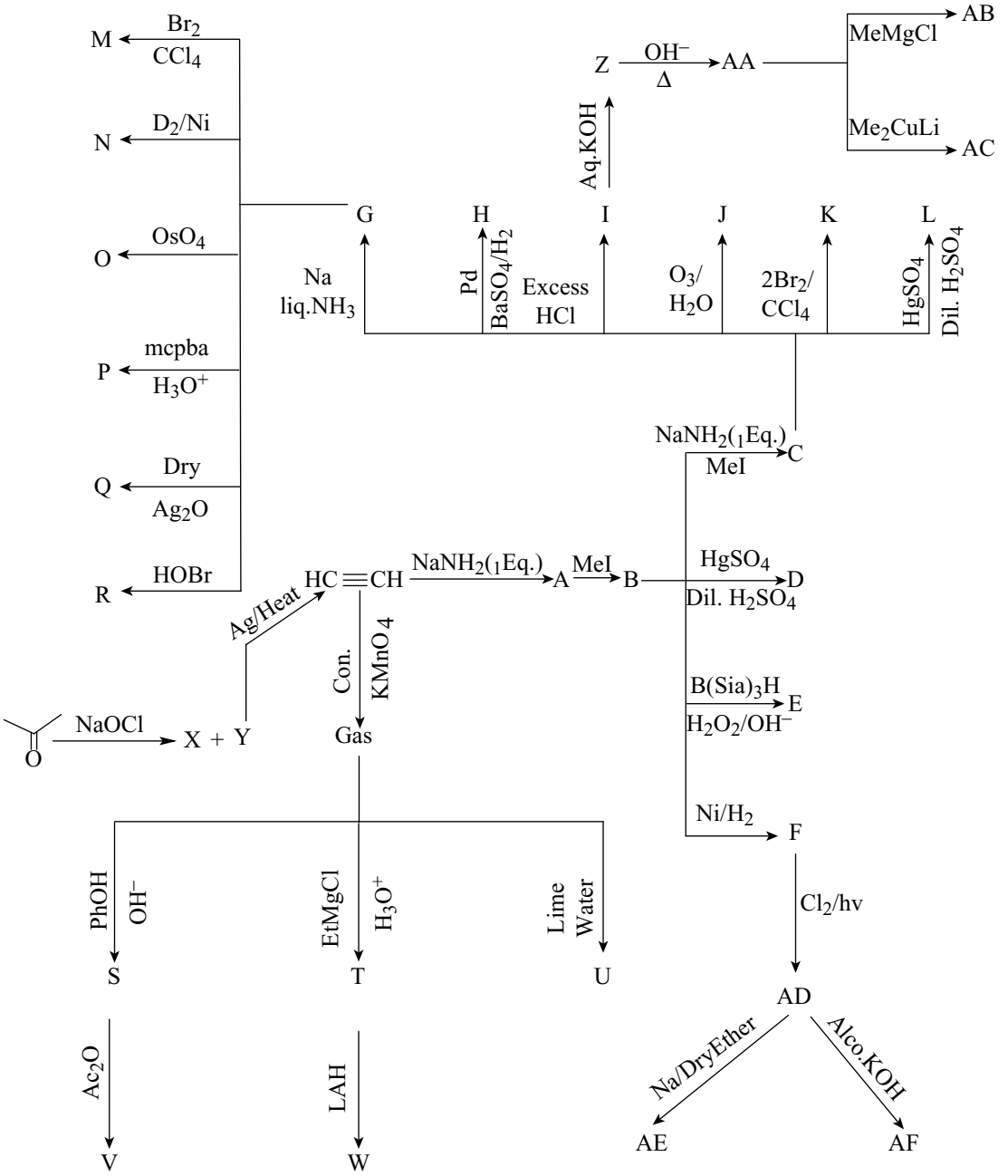
15. 
H3C
CH
Excess HCl
CCl4
A
Aq. NaOH
B
(1) MeMgCl/D.E
(2) H2O
C

16. 
NBS
A
Aq. NaOH
B
conc. H2SO4
Δ
C

17. 
H3C
CH2
NBS
A
Aq. NaOH
B
conc. H2SO4
Δ
C
D
HCl/CCl4
50 °C

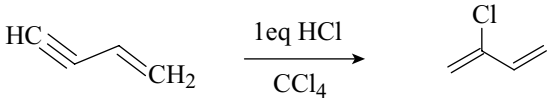
18. 
H3C
CH3
H2/Pd/BaSO4
A
Br2
CCl4
B

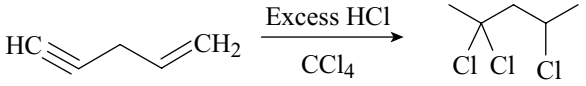
EXERCISE 2

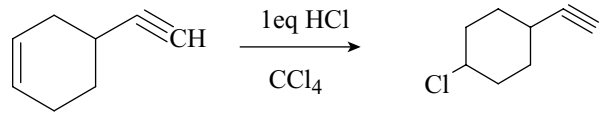

M
Br2
CCl4
N
D2/Ni
O
OsO4
P
mcpba
H3O+
Q
Dry
Ag2O
R
HOBr
Z
OH−
Δ
AA
MeMgCl
AB
Me2CuLi
AC
Aq.KOH
G
H
I
J
K
L
Na
liq.NH3
Pd
BaSO4/H2
Excess
HCl
O3/
H2O
2Br2/
CCl4
HgSO4
Dil. H2SO4
NaNH2(1Eq.)
MeI
C
HC≡CH
NaNH2(1Eq.)
A
MeI
B
HgSO4
Dil. H2SO4
D
Ag/Heat
Con.
KMnO4
B(Sia)3H
H2O2/OH−
E
NaOCl
X + Y
Gas
Ni/H2
F
PhOH
OH−
S
EtMgCl
H3O+
T
Lime
Water
U
Cl2/hv
AD
Ac2O
V
LAH
W
Na/DryEther
Alco.KOH
AE
AF

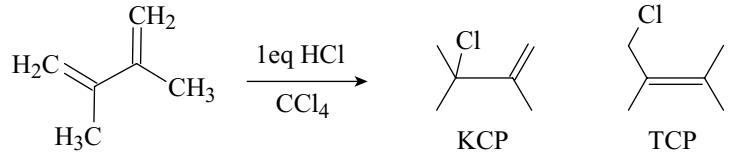
SOLUTION FOR WORKBOOK EXERCISES

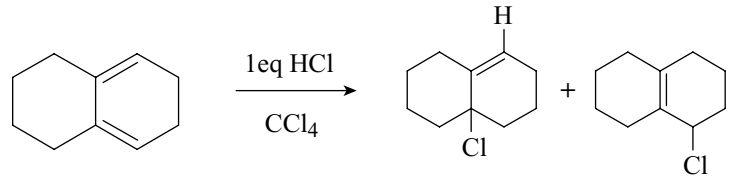
EXERCISE 1

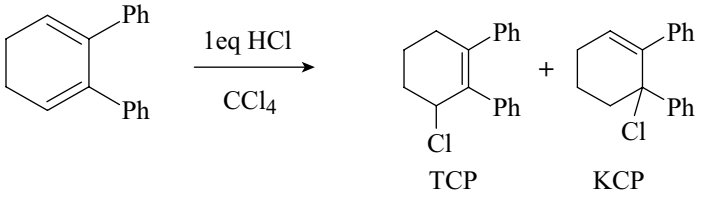
1. 

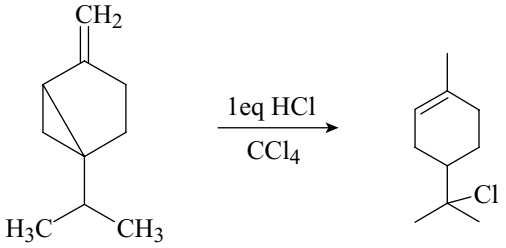
2. 

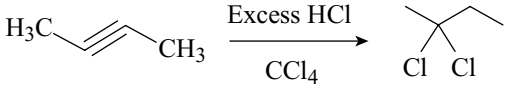
3. 

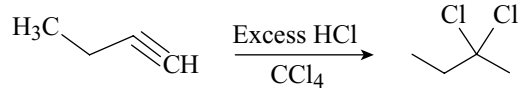
4. 

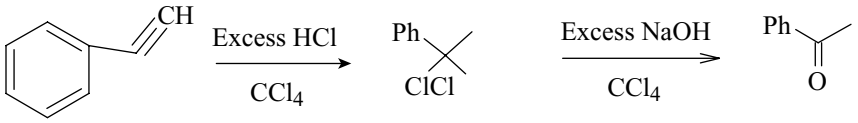
5. 

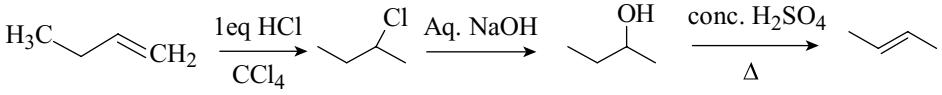
6. 

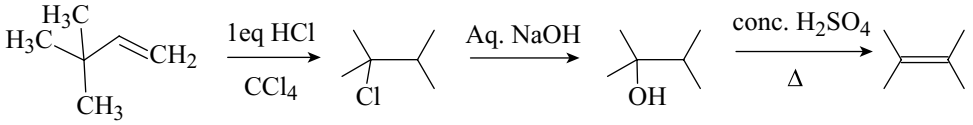
7. 

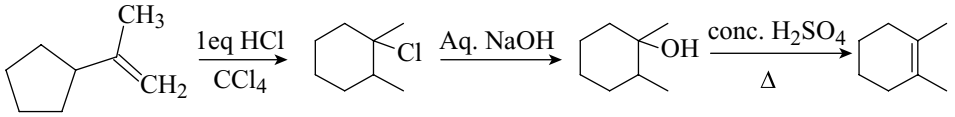
8. 

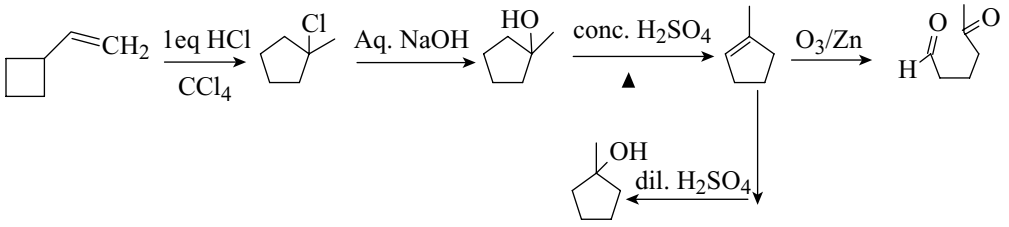
9. 

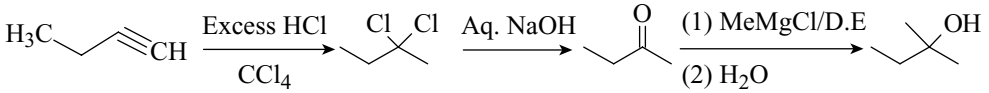
10. 

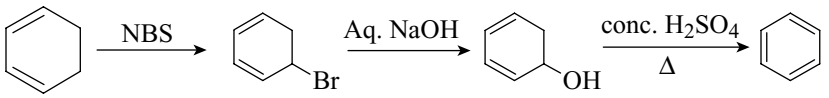
11. 

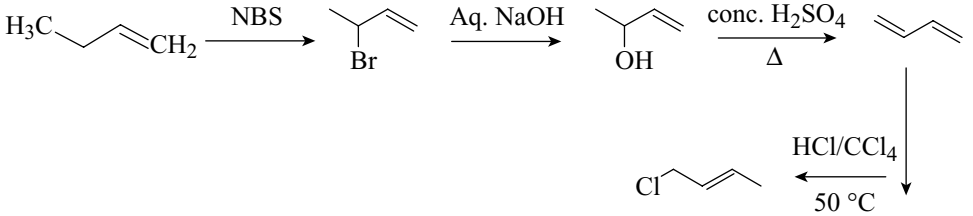
12. 

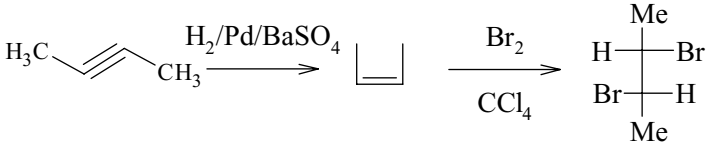
13. 

14. 

15. 

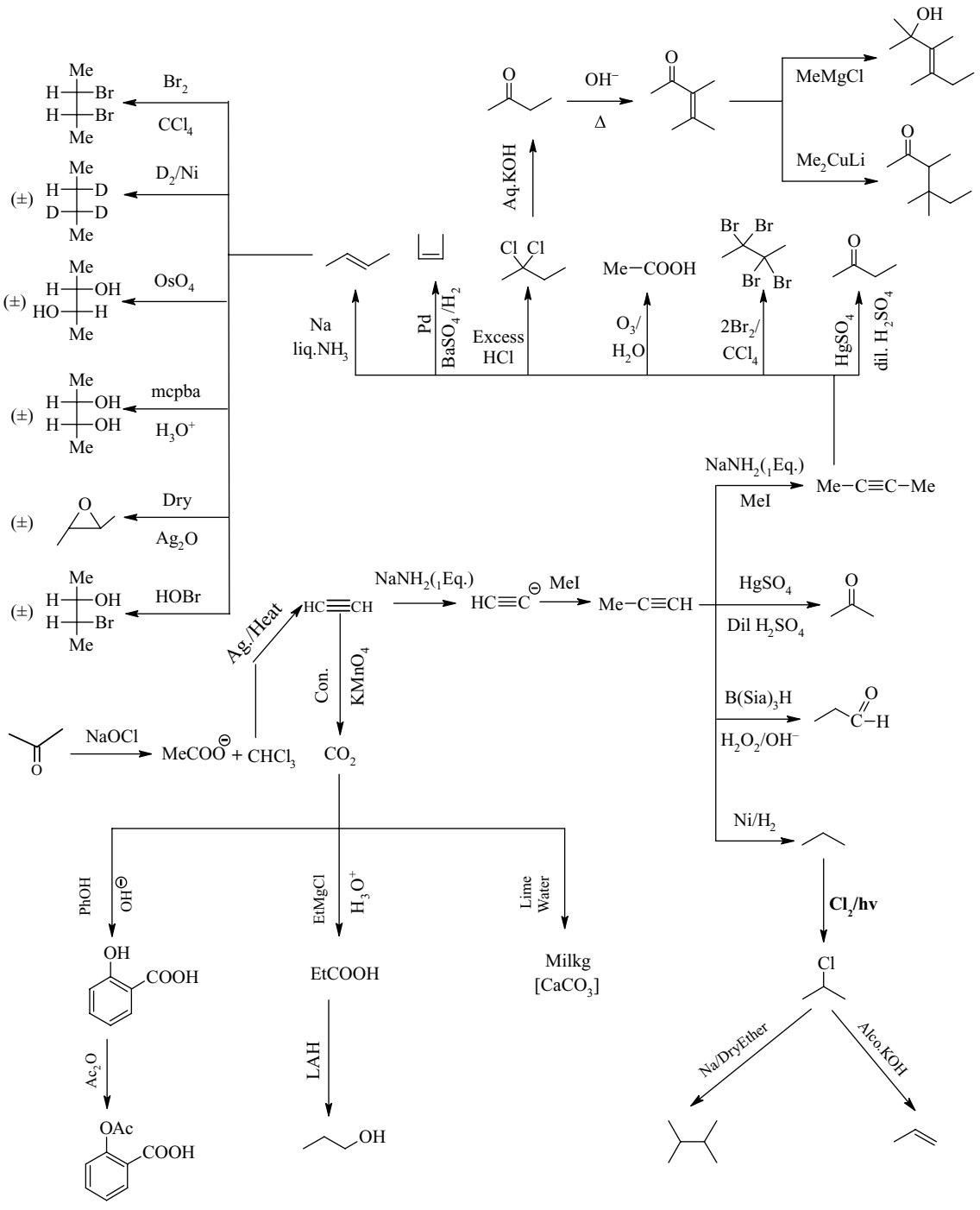
16. 

17. 

18. 

(I)

EXERCISE 2


Br2
CCl4
D2/Ni
OsO4
mcpba
H3O+
Dry
Ag2O
HOBr
Aq.KOH
OH⁻
Δ
MeMgCl
Me2CuLi
Na
liq.NH3
Pd
BaSO4/H2
Excess
HCl
O3/
H2O
2Br2/
CCl4
HgSO4
dil. H2SO4
Me−COOH
NaNH2(1Eq.)
MeI
Me−C≡C−Me
HgSO4
Dil H2SO4
B(Sia)3H
H2O2/OH⁻
Ni/H2
Cl2/hv
Na/DryEther
Alco.KOH
Ag,/Heat
HC≡CH
NaNH2(1Eq.)
HC≡C⊖
MeI
Me−C≡CH
Con.
KMnO4
NaOCl
MeCOO⊖ + CHCl3
CO2
PhOH
OH⊖
EtMgCl
H3O+
Lime
Water
Milkg
[CaCO3]
EtCOOH
LAH
Ac2O