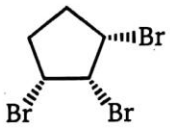
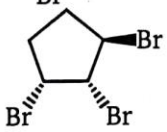
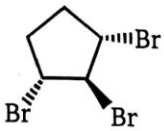
4B HYDROCARBONS (ALKENES)

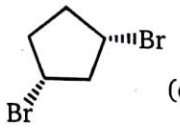
LEVEL-1

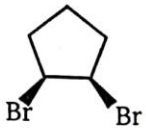
1. (R)-3-bromocyclopentene (shown below) reacts with Br_2/CCl_4 to form two products, Y and Z, Y is not optically active (does not rotate plane-polarized light). What is the structure of Y ?

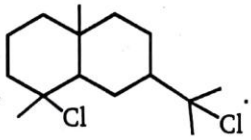
(a) 

(b) 

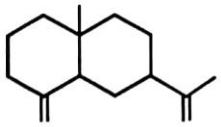
(c) 

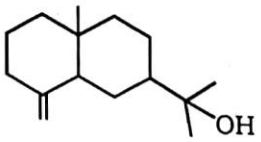
(d) 

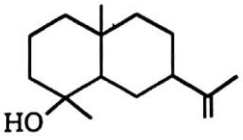
(e) 

2. $A \xrightarrow{2HCl}$ 

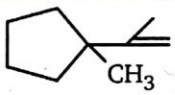
. Reactant (*A*) can be:

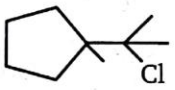
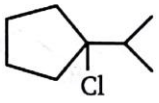
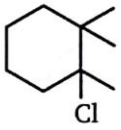
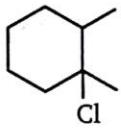
(a) 

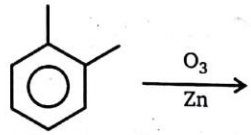
(b) 

(c) 

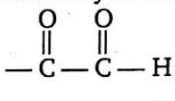
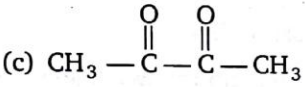
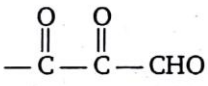
(d) All of these

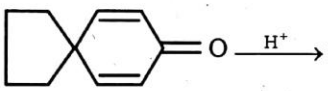
3.  ; Major product of the reaction is :

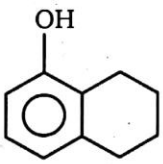
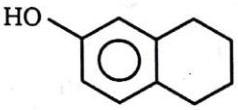
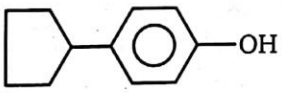
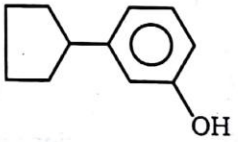
(a) 
(b) 
(c) 
(d) 

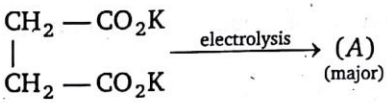
4. 

Which of the following products cannot be obtained in ozonolysis of *o*-xylene?

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

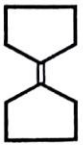
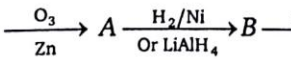
5.  Major product of the reaction is :

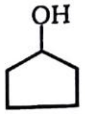
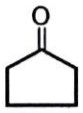
(a) 
(b) 
(c) 
(d) 

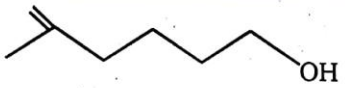
6. 

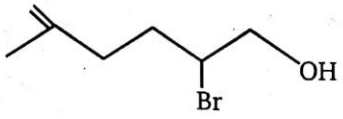
Product (*A*) of the reaction is :

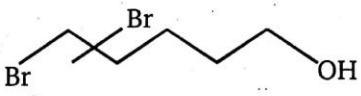
(a) CH_3-CH_3
(b) $CH_2=CH_2$
(c) $CH_3-CH=CH_2$
(d) none of these

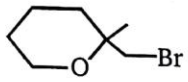
7.   ; Product (*C*) of the reaction is :

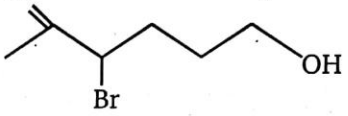
(a) 
(b) 
(c) 
(d) 

8.  $\xrightarrow[CH_2Cl_2]{Br_2}$ *W*. Product *W* is :

(a) 

(b) 

(c) 

(d) 

9. The reaction of propene with H_3O^+ will proceed with which of the following intermediates ?

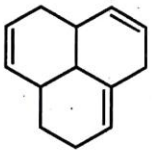
(a) $CH_3-CH_2-\overset{\oplus OH_2}{\underset{|}{CH_2}}$

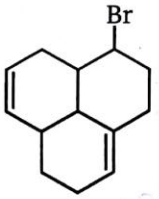
(b) $CH_3-\overset{\oplus}{C}H-\overset{OH}{\underset{|}{CH_2}}$

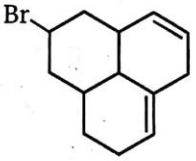
(c) $CH_3-\overset{\oplus OH_2}{\underset{|}{CH}}-CH_3$

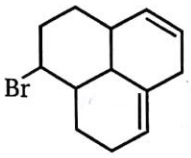
(d) $CH_3-\overset{OH}{\underset{|}{CH}}-CH_3$

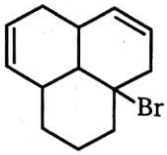
10. Which of the following bromides is the major product of the reaction shown below, assuming that there are no carbocation rearrangement ?

 + $\underset{(1\ \text{equivalent})}{HBr} \longrightarrow C_{13}H_{17}Br$

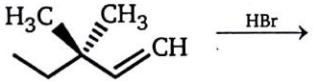
(a) 

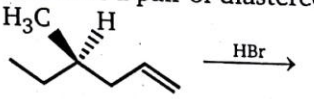
(b) 

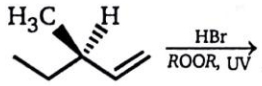
(c) 

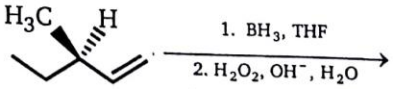
(d) 

11. Which of the following reactions results in the formation of a pair of diastereomers ?

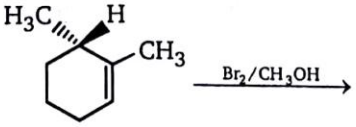
(a) 

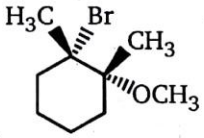
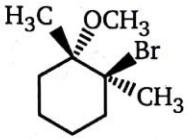
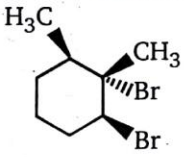
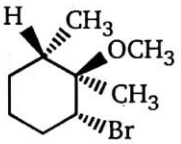
(b) 

(c) 

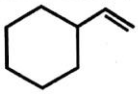
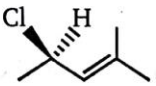
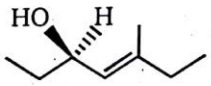
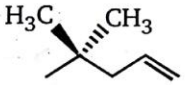
(d) 

12. What is a likely product of the reaction shown ?

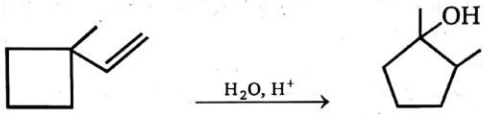


(a)  (b)  (c)  (d) 

13. Which of the following, when undergoing addition of HBr, will form ONLY a pair of diastereomers ?

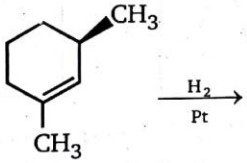
(a)  (b)  (c)  (d) 

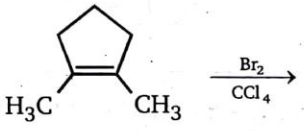
14. How many transition states and intermediates will be formed during the course of following reaction ?

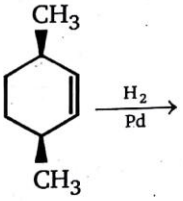


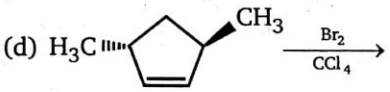
(a) 3 transition states and 3 intermediates (b) 4 transition states and 3 intermediates
(c) 3 transition states and 2 intermediates (d) 5 transition states and 4 intermediates

15. Product of which of the following reactions, is racemic mixture ?

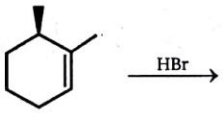
(a) 

(b) 

(c) 

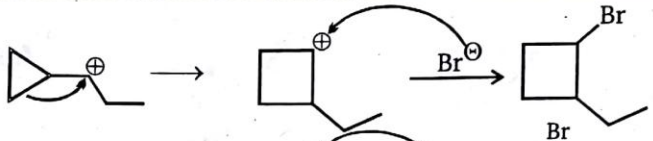
(d) 

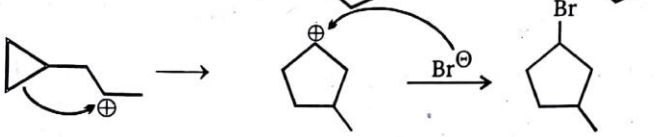
16. The product(s) of the following reaction can best be described as :

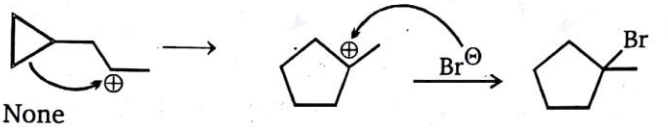


(a) a racemic mixture (b) a single enantiomer
(c) a pair of diasteriomers (d) an achiral molecule

17. Taking into account the stability of various carbocations and, as well as the rules governing mechanisms of carbocation rearrangements, which reaction is most likely to occur during the given reaction ?

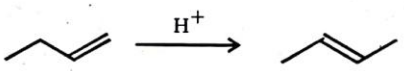
(a) 

(b) 

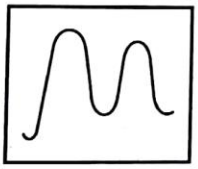
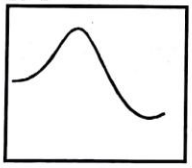
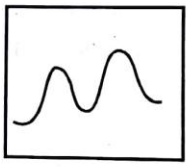
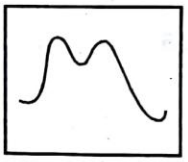
(c) 

(d) None

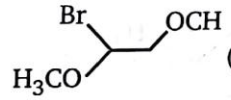
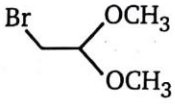
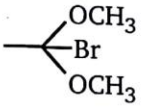
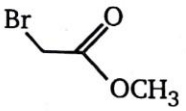
18. Consider the following reaction in which the intermediate carbocation loses H^+ to give the final product ?



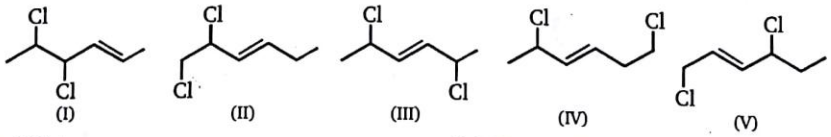
Which of the following energy profiles best represents the overall reaction ?

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

19. Methyl vinyl ether, $H_2C = CH - OCH_3$, reacts with Br_2/CH_3OH. If methanol is reacting as water would, and if this reaction follows a typical mechanism of electrophilic addition, what would be the expected product ?

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

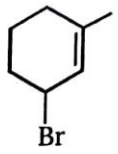
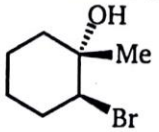
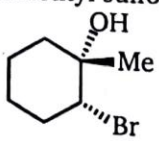
20. 2, 4-hexadiyne (C_6H_6) is allowed to react with Li in NH_3(liq). The product obtained is treated with 1 equivalent of Cl_2 in CCl_4. Which of the following constitutional isomers are possible products ?



(I) (II) (III) (IV) (V)

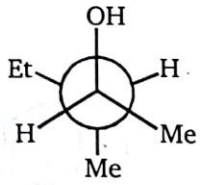
(a) I and II
(b) II and III
(c) I and V
(d) I and III

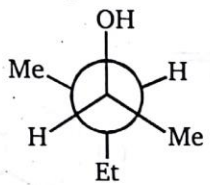
21. Which of the following is the best stereochemical representation when reaction between 1-methylcyclohexene and NBS react in aqueous dimethyl sulfoxide ?

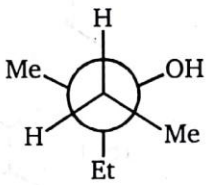
(a)  (b)  (c) 

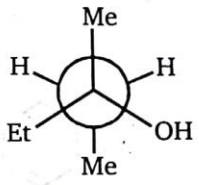
(d) None of these

22. Which of the following is among the major products of the reaction of (E)-3-methyl-2-pentene with BH_3 in THF followed by the addition of H_2O_2/HO^-?

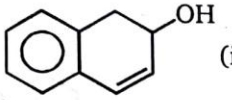
(a) 

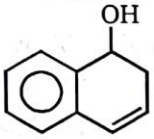
(b) 

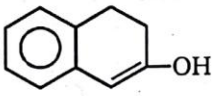
(c) 

(d) 

23. Compare rate of dehydration of (i), (ii) and (iii) by conc. H_2SO_4.

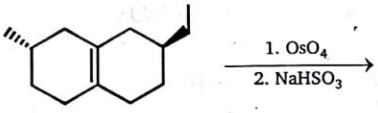
(i) 

(ii) 

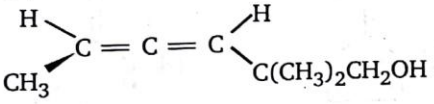
(iii) 

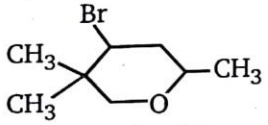
(a) (i) > (iii) > (ii)
(b) (i) > (ii) > (iii)
(c) (ii) > (i) > (iii)
(d) (ii) > (iii) > (i)

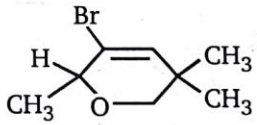
24. How many products will be formed in this reaction ?

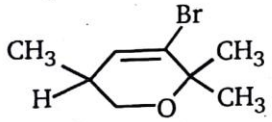


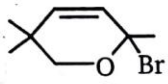
(a) 10
(b) 2
(c) 3
(d) 4

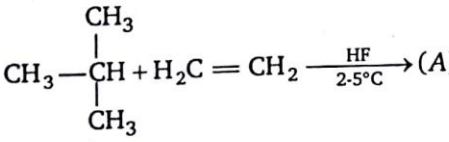
25.  (A). Product (A) of the reaction is:

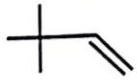
(a) 

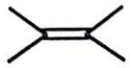
(b) 

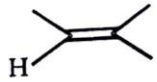
(c) 

(d) 

26.  (A); (A) is:

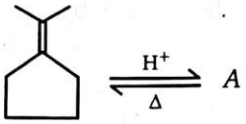
(a) 

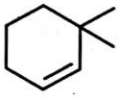
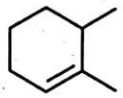
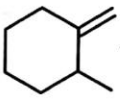
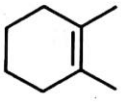
(b) 

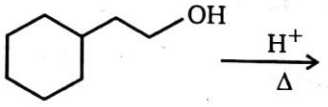
(c) 

(d) $CH_3-\underset{\displaystyle CH_3}{\overset{}{CH}}-CH_2-CH=CH_2$

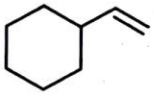
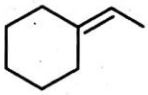
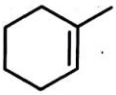
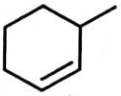
27. Predict the product (*A*) of the following reaction



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

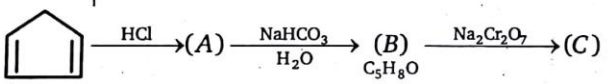
28. 

(*A*) Major-product (*A*) is:
(Major)

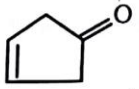
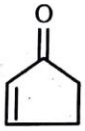
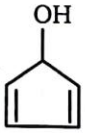
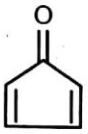
(a)  (b)  (c)  (d) 

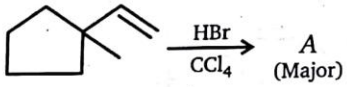
29. Di-imide (N_2H_4) is used to reduce double bond of:

(a) $-\underset{|}{C}=O$ (b) $-C\equiv N$ (c) $-NO_2$ (d) $-CH=CH-$

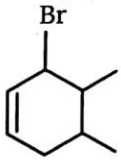
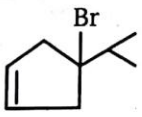
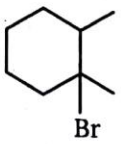
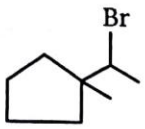
30. 

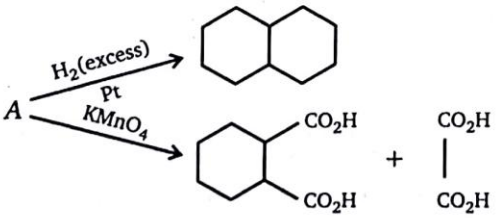
End product of the reaction is :

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

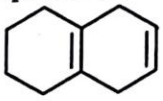
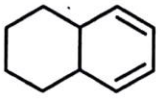
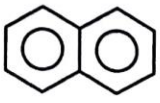
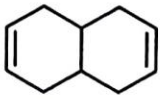
31. 

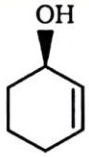
Product (*A*) is :

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

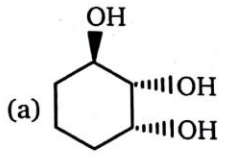
32. 

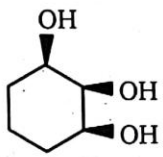
Compound (*A*) is :

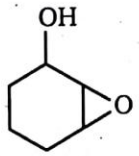
(a)  (b)  (c)  (d) 

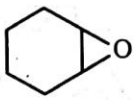
33.  $\xrightarrow{OsO_4}$ $X + Y$ (12 : 1)

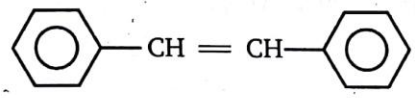
Product (X) will be :

(a) 

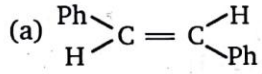
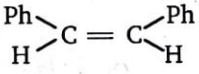
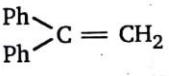
(b) 

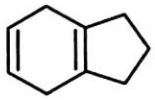
(c) 

(d) 

34.  $\xrightarrow[CCl_4]{Br_2}$ A $\xrightarrow{2NaNH_2}$ B $\xrightarrow[Pd/CaCO_3]{H_2}$ C

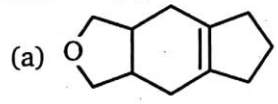
Product (C) is

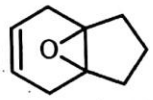
(a)  (b)  (c)  (d) Ph — C ≡ C — Ph

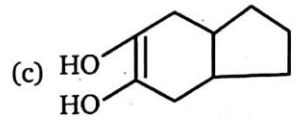
35.  $\xrightarrow[\text{Ethanol}]{\text{MMPP(one-equivalent)}}$ X (74%)

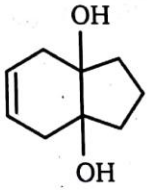
MMPP ⟶ Magnesium mono peroxy phthalate.

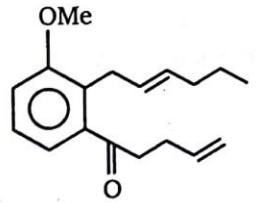
Product (X) is :

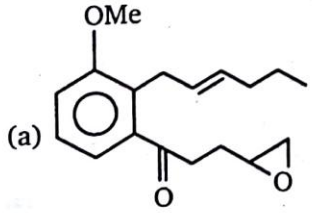
(a) 

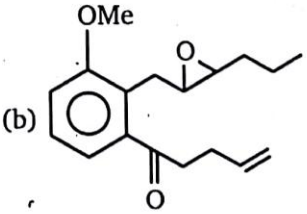
(b) 

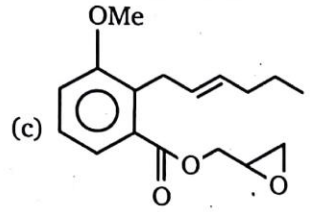
(c) 

(d) 

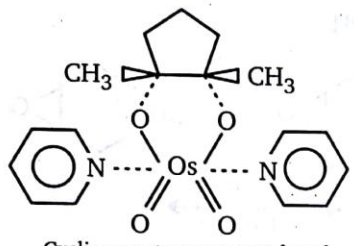
36.  $\xrightarrow{MCPBA}$ P (75%) ; Product (P) is :

(a) 

(b) 

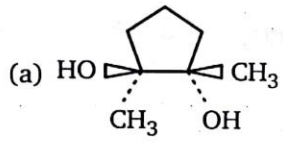
(c) 

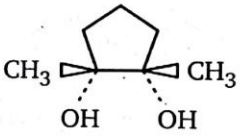
(d) None of these

37. 

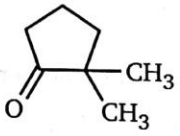
Cyclic osmate ester complexed with pyridine

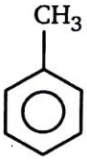
$\xrightarrow[\text{Mannitol/Water}]{\text{KOH}}$ A; Product (A) is :

(a) 

(b) 

(c) 

(d) 

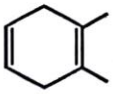
38. 

$+ CBrCl_3 \xrightarrow{h\nu} (A)$ (no ring substitution)

Product (A) is :

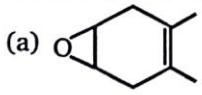
(a) $Ph-CH_2-Cl$ (b) $Ph-CH_2-Br$

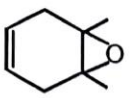
(c) $Ph-CH_2-CCl_3$ (d) $Ph-CH_2-CBrCl_2$

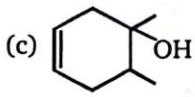
39. 

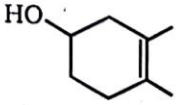
$\xrightarrow{\text{MCPBA}}$ (A) ; MCPBA $\longrightarrow$ metachloroperbenzoic acid

Product (A) of the above reaction is :

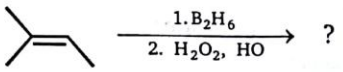
(a) 

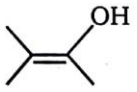
(b) 

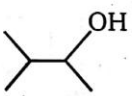
(c) 

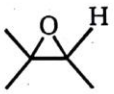
(d) 

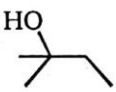
40. The major product of the following reaction sequence is :



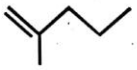
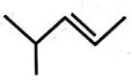
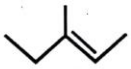
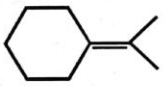
(a) 

(b) 

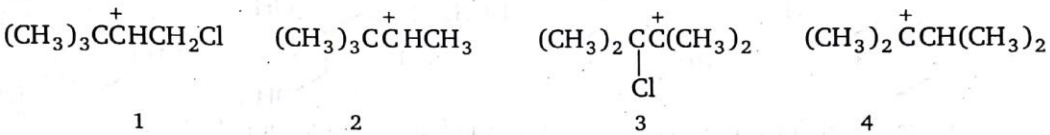
(c) 

(d) 

41. Which one of the following compounds gives acetone $(CH_3)_2C=O$ as one of the product of its ozonolysis ?

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

42. Addition of HCl to 3, 3-dimethyl-1-butene yields two products, one of which has a rearranged carbon skeleton. Among the following carbocations, select the possible intermediates in that reaction ?



1 2 3 4

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

43. Conversion of cyclohexene to cyclohexanol can be conveniently achieved by :

(a) $NaOH + H_2O$ (b) $Br_2 - H_2O$
(c) hydroboration, oxidation (d) hydroboration hydrolysis

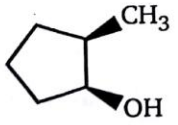
44. *Trans*-cyclohexane-1,2-diol can be obtained by the reaction of cyclohexene with :

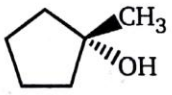
(a) $KMnO_4$ (b) OsO_4
(c) peroxy formic acid $/H_3O^+$ (d) SeO_2

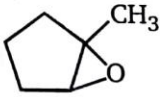
45. Bromination of (E)-2-butenedioic acid gives

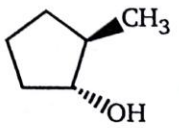
(a) (2R, 3S)-2, 3-dibromosuccinic acid
(b) (2R, 3R)-2, 3-dibromosuccinic acid
(c) a mixture of (2R, 3R) and (2S, 3S)-2, 3-dibromosuccinic acid
(d) (2S, 3S)-2, 3-dibromosuccinic acid

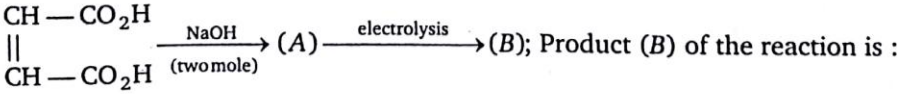
46. The major product formed during the reaction of 1-methyl cyclopentene with CH_3CO_3H is

(a) 

(b) 

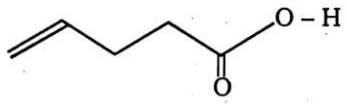
(c) 

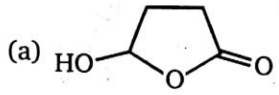
(d) 

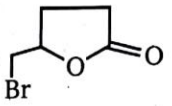
47. 

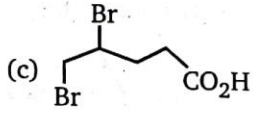
; Product (B) of the reaction is :

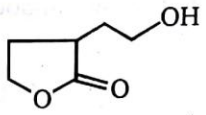
(a) $CH_3 - CH_3$ (b) $H_2C=CH_2$
(c) $H-C\equiv C-H$ (d) $CH_2=CH-CH=CH_2$

48. 

(a) 

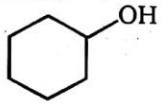
(b) 

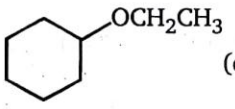
(c) 

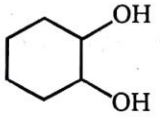
(d) 

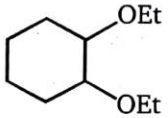
49. 
Cyclohexene

$\xrightarrow[(2)\ NaBH_4,\ HO^-]{(1)\ (CF_3CO_2)_2Hg,\ CH_3CH_2OH}$ (*P*) (100%) ; Product (*P*) is :

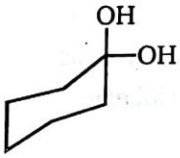
(a) 

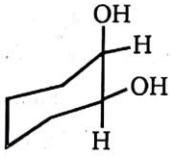
(b) 

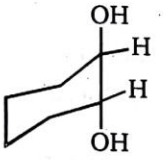
(c) 

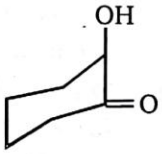
(d) 

50. What is the major product expected from the following reaction ?

(a) 

(b) 

(c) 

(d) 

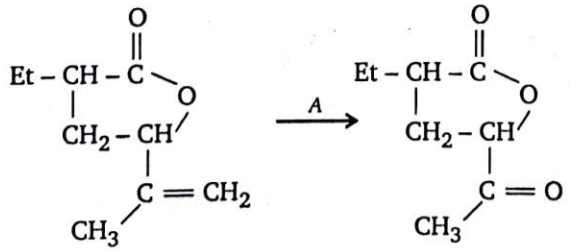
51. $CH_3-CH=CH_2 \xrightarrow[\text{(low conc.)}]{Br_2/hv}$ (*A*) ; Product (*A*) of the reaction is :

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

(b) $H_2C=CH-CH_2-Br$

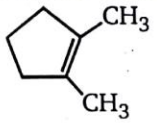
(c) $CH_3-\underset{\displaystyle Br}{\underset{|}{C}}=CH_2$

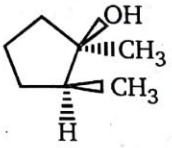
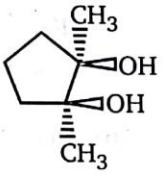
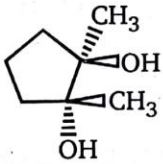
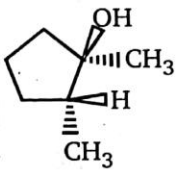
(d) $Br-CH_2-CH_2-CH_2-Br$

52. 

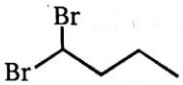
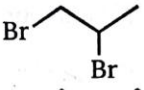
; Reagent (*A*) in the reaction is :

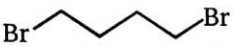
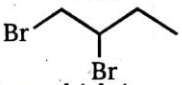
(a) $O_3/Zn(H_2O)$ (b) HIO_4 (c) CrO_3 (d) Cold dil. $KMnO_4$

53.  $\xrightarrow[2.\ NaHSO_3]{1.\ OsO_4}$ Product of the reaction is:

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

54. Which compound is a possible product from addition of Br_2 to 1-butene ?

(a)  (b) 

(c)  (d) 

55. Addition of Br_2 to *cis*-2-butene would give a product which is:

(a) achiral (b) racemic

(c) meso (d) optically active

56. Addition of Br_2 to *trans*-2-butene would give a product which is:

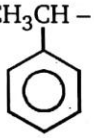
(a) achiral (b) racemic (c) meso (d) optically active

57. Addition of OsO_4 to cyclopentene would give a product which is:

(a) achiral (b) racemic (c) meso (d) optically active

58. Addition of BH_3 followed by H_2O_2 to *trans*-2-butene would give a product which is:

(a) achiral (b) racemic (c) meso (d) optically active

59. $CH_3CHCH = CH_2$  $\xrightarrow{A}$ $CH_3CH - CHCH_3$  ; Reagent *A* may be :

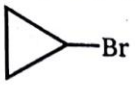
(a) H_2O/H^+ (b) $BH_3.THF/H_2O_2 - OH^-$

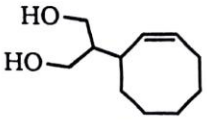
(c) $Hg(OCOCH_3)_2.H_2O/NaBH_4.NaOH$ (d) All are possible

60. The major product of the following reaction is :

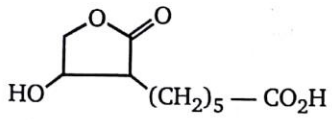
$$CH_3 - CH = CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2}$$

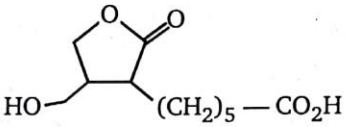
(a) $CH_3 - CH_2 - CH_2 - Br$ (b) $CH_3CH(Br) - CH_3$

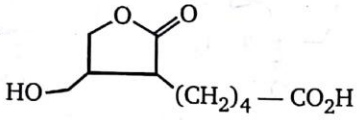
(c) $BrCH_2 - CH = CH_2$ (d) 

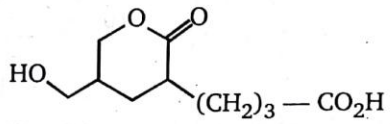
61.  $\xrightarrow[H_2O_2]{O_3}(A) \xrightarrow[\Delta]{-H_2O}(B)$

Identify (*B*) :

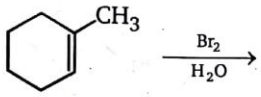
(a) 

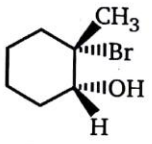
(b) 

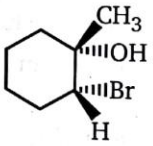
(c) 

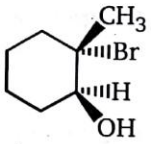
(d) 

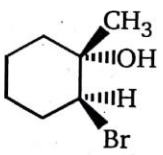
62. Which of the following is a major product of the reaction shown below?



(a) 

(b) 

(c) 

(d) 

63. In methyl alcohol solution, bromine reacts with ethylene (ethene) to yield $BrCH_2CH_2OCH_3$ in addition to 1, 2-dibromoethane because

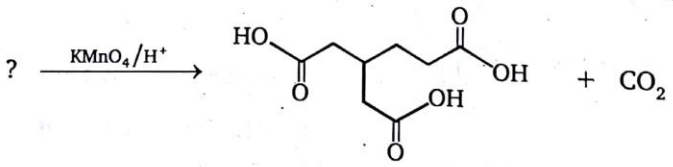
(a) the methyl alcohol solvates the bromine

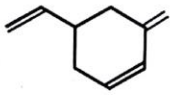
(b) the ion formed initially may react with Br^- or CH_3OH

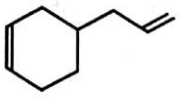
(c) this is a free radical reaction

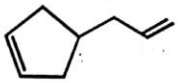
(d) the reaction follows Markovnikov's rule

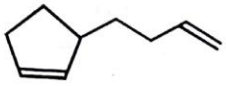
64. Which of the following compound was the starting material for the oxidation shown below ?



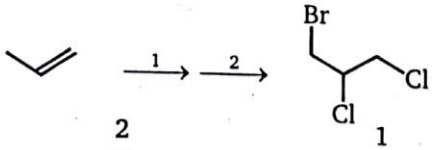
(a) 

(b) 

(c) 

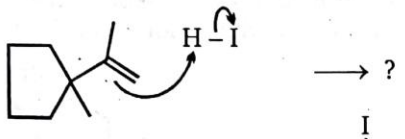
(d) 

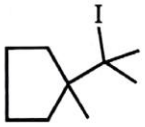
65. Which series of reactions will achieve the following transformation ?

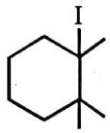


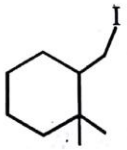
1	2	1	2
(a) Cl_2/CCl_4	Br_2	(b) HBr	Cl_2/CCl_4
(c) Cl_2/CCl_4	NBS/hν	(d) NBS/hν	Cl_2/CCl_4

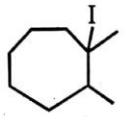
66. Taking into account the stability of various cycloalkanes and carbocations, as well as the rules governing mechanisms of carbocation rearrangements, what is the most likely product of this reaction ?



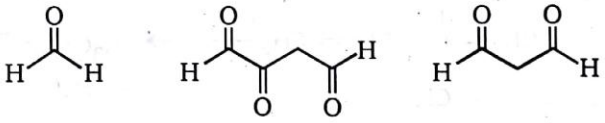
(a) 

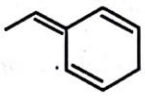
(b) 

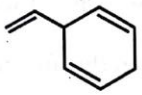
(c) 

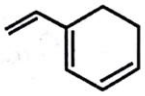
(d) 

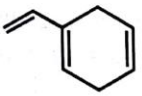
67. A triene is treated with ozone followed by zinc in acetic acid to give the following three products. What is the structure of the triene ?

Products = 

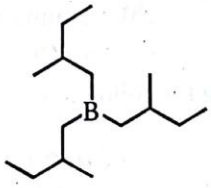
(a) 

(b) 

(c) 

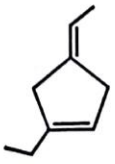
(d) 

68. Which of the following compound would yield trialkylborane shown below when treated with BH_3/THF ?



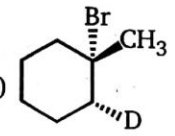
(a) 2-methylbut-1-ene
(b) 2-methylbut-2-ene
(c) 3-methylbut-1-ene
(d) 3-methylbut-1-yne

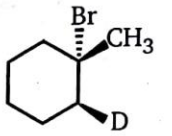
69. If the following compound is treated with Pd/C in excess of hydrogen gas, how many stereoisomers of the product will be obtained ?

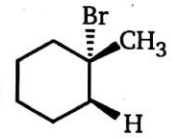


(a) 1 (b) 2
(c) 3 (d) 4

70. Which is the most precise designation of stereochemistry for the products formed in the electrophilic addition of DBr to 1-methylcyclohexene ? (D = ^2H, an isotope of hydrogen)

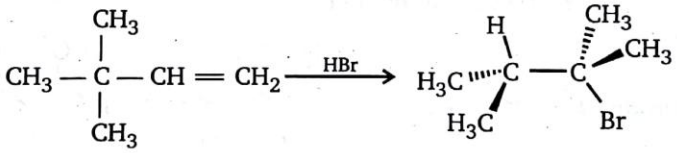
(a) 

(b) 

(c) 

(d) both (a) and (b)

71. Consider the addition of HBr to 3,3-Dimethyl-1-butene shown below. What is the best mechanistic explanation for the formation of the observed product ?



(a) Protonation of the alkene followed by a hydride shift and addition of bromide to the carbocation
(b) Double bond shift in the alkene following by the protonation and addition of bromide to the carbocation
(c) Addition of bromide to the alkene followed by a double bond shift and protonation
(d) Protonation of the alkene followed by a methyl shift and addition of bromide to the carbocation

72. Propene $CH_3CH = CH_2$ can be converted into 1-propanol by oxidation. Indicate which sets of reagents amongst the following is ideal to effect the above conversion ?

(a) $KMnO_4$ (alkaline) (b) Osmium tetroxide (OsO_4/CH_2Cl_2)
(c) B_2H_6 and alk. H_2O_2 (d) O_3/Zn

73. Which is the most suitable reagent among the following distinguish compound (3) from the others ?

(1) $CH_3C \equiv C - CH_3$ (2) $CH_3CH_2 - CH_2 - CH_3$
(3) $CH_3CH_2C \equiv CH$ (4) $CH_3CH = CH_2$
(a) Bromine in carbon tetrachloride (b) Bromine in acetic acid solution
(c) Alk. $KMnO_4$ (d) Ammonical silver nitrate

74. The principal organic product formed in the reaction given below is :

$CH_2 = CH(CH_2)_8COOH + HBr \xrightarrow{\text{peroxide}} ....$

(a) $CH_3 - CHBr(CH_2)_8COOH$ (b) $CH_2 = CH(CH_2)_8COBr$
(c) $CH_2BrCH_2(CH_2)_8COOH$ (d) $CH_2 = CH(CH_2)_7CHBrCOOH$

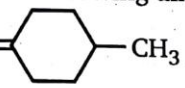
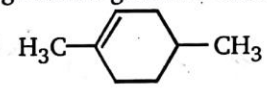
75. When 2-butyne is treated with Pd – $BaSO_4$; the product formed will be :

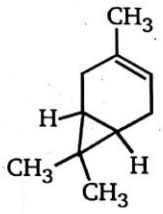
(a) *cis*-2-butene (b) *trans*-2-butene (c) 1-butene (d) 2-hydroxy butane

76. In the reaction, $CH_3C \equiv C - CH_3 \xrightarrow[(ii)\ Zn/H_2O]{(i)\ X} CH_3 - \underset{\underset{O}{\|}}{C} - \underset{\underset{O}{\|}}{C} - CH_3$, X is :

(a) HNO_3 (b) O_2 (c) O_3 (d) $KMnO_4$

77. Which of the following alkene on catalytic hydrogenation given *cis* and *trans*-isomer ?

(a)  (b) 

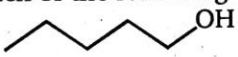
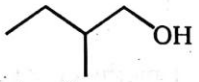
(c)  (d) all of these

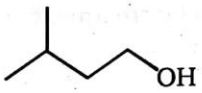
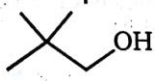
78. In the reaction of hydrogen bromide with an alkene (in the absence of peroxides), the first step of the reaction is the ..... to the alkene.

(a) fast addition of an electrophilic (b) slow addition of an electrophile

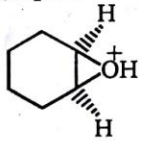
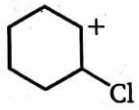
(c) fast addition of a nucleophilic (d) slow addition of a nucleophile

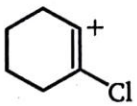
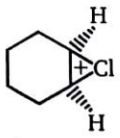
79. Which of the following alcohols cannot be prepared from hydration of an alkene ?

(a)  (b) 

(c)  (d) 

80. Which of the species shown below is the most stable form of the intermediate in the electrophilic addition of Cl_2 in water to cyclohexene to form a halohydrin ?

(a)  (b) 

(c)  (d) 

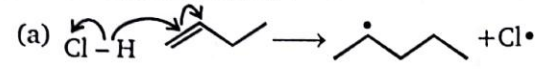
81. The reaction, $(CH_3)_2C = CH_2 + Br^{\bullet} \longrightarrow (CH_3)_2\dot{C} - CH_2Br$

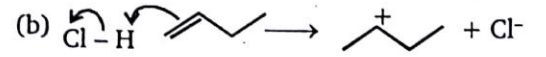
is an example of a/an ..... step in a radical chain reaction.

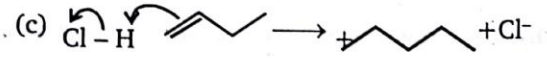
(a) initiation (b) termination

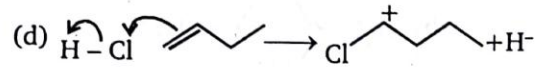
(c) propagation (d) heterolytic cleavage

82. Which of the following most accurately describes the first step in the reaction of hydrogen chloride with 1-butene ?

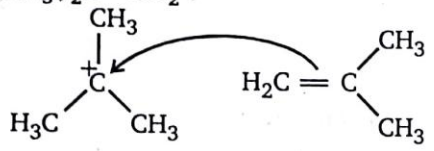
(a) 

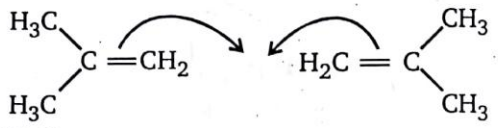
(b) 

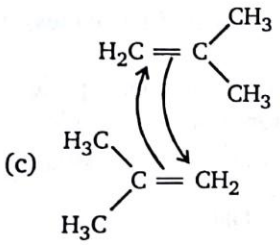
(c) 

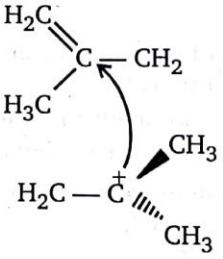
(d) 

83. Which of the following best describes the flow of electrons in the acid-catalyzed dimerization of $(CH_3)_2C=CH_2$?

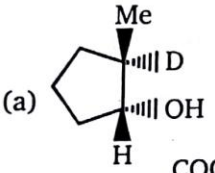
(a) 

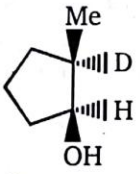
(b) 

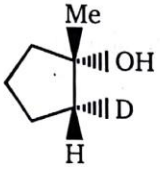
(c) 

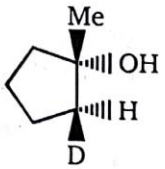
(d) 

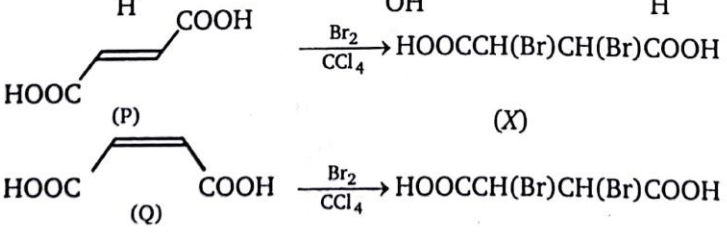
84. Hydroboration of 1-methylcyclopentene using B_2D_6, followed by treatment with alkaline hydrogen peroxide, gives

(a) 

(b) 

(c) 

(d) 

85. 

The correct statements with respect to the above pair of reactions are that

(I) the reactions are stereospecific

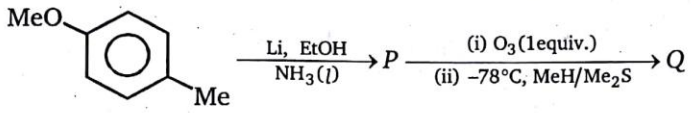
(II) (*X*) is erythro and (*Y*) is threoisomer

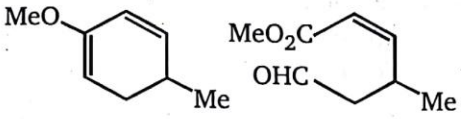
(III) (*X*) is threo and (*Y*) is erythro isomer

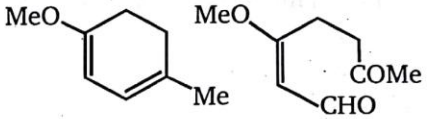
(IV) each of (*P*) and (*Q*) gives a mixture of (*X*) and (*Y*)

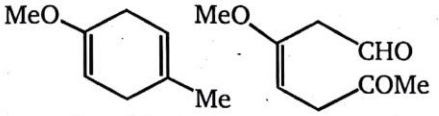
(a) I and II (b) I and III (c) I and IV (d) II and IV

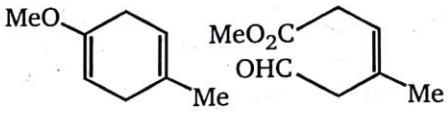
86. The products *P* and *Q* in the following sequence of reactions, are



(a) 

(b) 

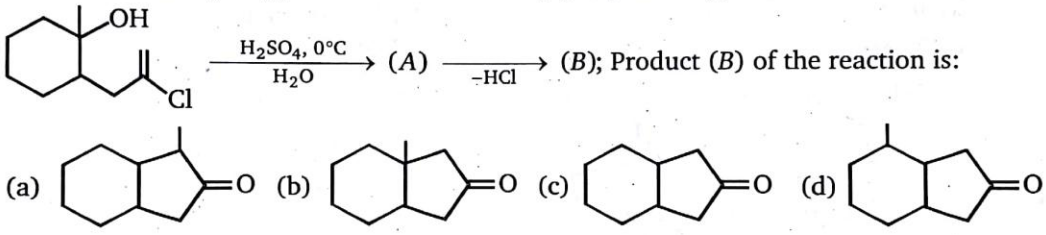
(c) 

(d) 

87. 4-Pentenoic acid when treated with I_2 and $NaHCO_3$ gives :

(a) 4, 5-diiodopentanoic acid (b) 5-iodomethyl-dihydrofuran-2-one

(c) 5-iodo-tetrahydropyran-2-one (d) 4-pentenolyiodide

88. 

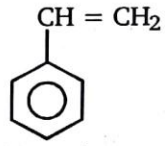
Product (*B*) of the reaction is:

(a)

(b)

(c)

(d)

89. 

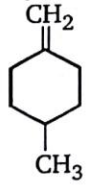
(Styrene)

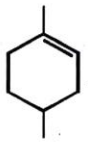
$\xrightarrow[CCl_4]{Br_2}$ (*A*) $\xrightarrow[(ii)\ NaNH_2]{(i)\ alc.KOH}$ (*B*) $\xrightarrow[(ii)\ CH_3-Cl]{(i)\ NaNH_2}$ (*C*), Product (*C*) is :

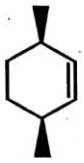
(a) $Ph-C\equiv CNa$ (b) $Ph-CH_2-C\equiv CH$

(c) $Ph-C\equiv C-CH_3$ (d) $Ph-CH=C=CH_2$

90. Which of the following will give a mixture of *cis* and *trans*-1,4-dimethyl cyclohexane, when undergo catalytic hydrogenation ?

(a) 

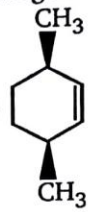
(b) 

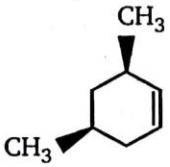
(c) 

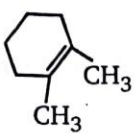
Cis-3-6 dimethyl cyclohexene

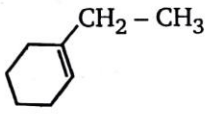
(d) both (a) & (b)

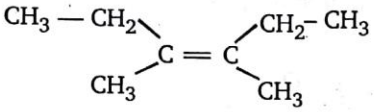
91. An optically active compound *A* with molecular formula C_8H_{14} undergoes catalytic hydrogenation to give meso compound, the structure of (*A*) is :

(a) 

(b) 

(c) 

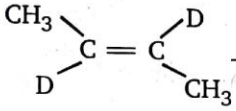
(d) 

92.  $+ HBr \xrightarrow[(Per\text{-}oxide)]{R_2O_2}$ Products

How many products will be formed in above reaction ?

(a) 2 (b) 4

(c) 3 (d) 6

93.  Product of the reacion is :

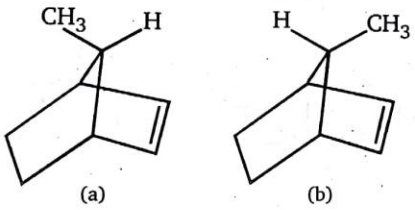
(a) Racemic (b) Diastereomers

(c) Meso (d) Pure enantiomers

94. *cis*-2-butene $\xrightarrow[Peroxide]{HBr}$ product ; Product of the reaction is :

(a) Racemic (b) Diastereomer

(c) Meso (d) *E* and *Z* isomer

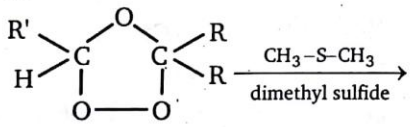
95. 

(a) (b)

Rate of reaction towards reduction using (H_2/Pt) :

(a) $a > b$ (b) $a = b$

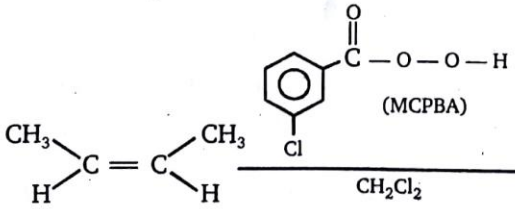
(c) $b > a$ (d) Reduction of given molecule is not possible

96.  Product *A* + $CH_3-\overset{\overset{O}{\|}}{S}-CH_3$

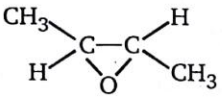
Product *A* of the above reaction is :

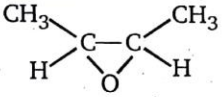
(a) $R-\overset{\overset{O}{\|}}{C}-R$ (b) $R'-CHO$

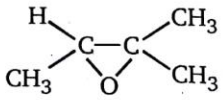
(c) $R-CO_2H$ (d) both (a) and (b)

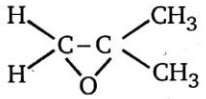
97. 

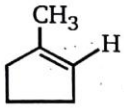
MCPBA ⟶ Metachloroperbenzoic acid

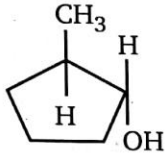
(a) 

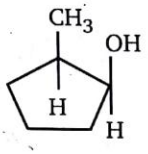
(b) 

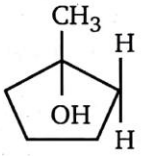
(c) 

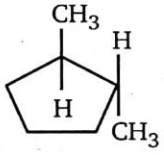
(d) 

98.  $\xrightarrow[(2)\ H_2O_2, HO^-]{(1)\ BH_3;\ THF}$ (*A*) ; Product of the reaction is :

(a) 

(b) 

(c) 

(d) 

99. $CH_3 - CH = CH_2 \xrightarrow[(2)\ CH_3CO_2T]{(1)\ THF : BD_3}$ (*A*) ; Product (*A*) of the above reaction is:

(a) $CH_3 - CHD - CH_2D$ (b) $CH_3 - CHT - CH_2T$

(c) $CH_3 - CHD - CH_2T$ (d) $CH_3 - CHT - CH_2D$

100. Optically active isomer (*A*) of (C_5H_9Cl) on treatment with one mole of H_2 gives an optically inactive compound (*B*) compound (*A*) will be :

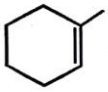
(a) $CH_3 - \underset{\displaystyle CH_2Cl}{\underset{|}{CH}} - CH = CH_2$ (b) $Cl - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH = CH - CH_3$

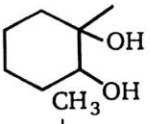
(c) $CH_3 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_2 - CH = CH_2$ (d) $CH_3 - CH_2 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH = CH_2$

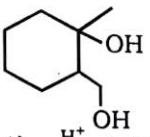
101. An organic compound C_4H_6 on ozonolysis give HCHO, CO_2, CH_3CHO. Compound will be :

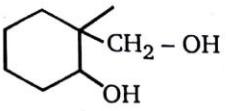
(a) $H_2C = CH - CH = CH_2$ (b) $CH_3 - CH = C = CH_2$

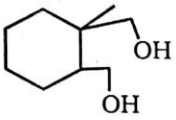
(C) $CH_3 - C \equiv C - CH_3$ (d) 

102.  $\xrightarrow[H_2O]{HCHO,\ H^+}$ major product of this reaction is :

(a) 

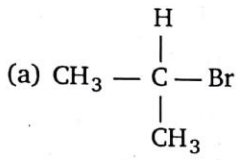
(b) 

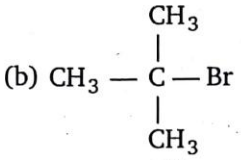
(c) 

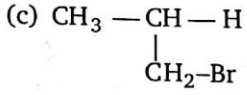
(d) 

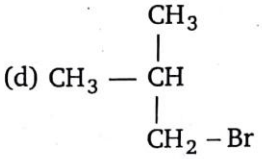
103. $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} \xrightarrow{KMnO_4}$ (*A*) $\xrightarrow[\Delta]{H^+}$ (*B*) $\xrightarrow[ROOR]{HBr}$ (*C*)

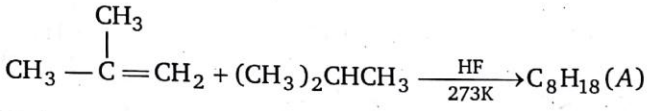
Product (*C*) in the above reactions is :

(a) 

(b) 

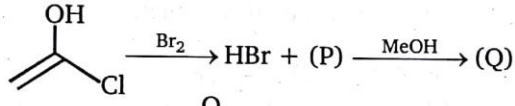
(c) 

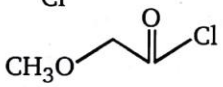
(d) 

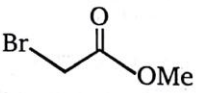
104. 

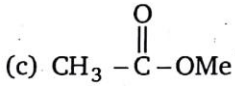
Unknown (*A*) in the above reaction is :

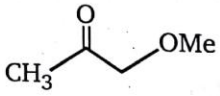
(a) 2, 2, 3-trimethyl pentane
(b) 2, 2, 4-trimethyl pentane
(c) 2, 2-dimethyl hexane
(d) *n*-octane

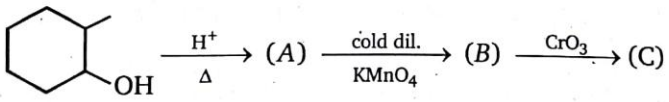
105.  ; Product (Q) is :

(a) 

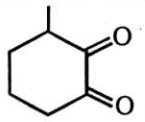
(b) 

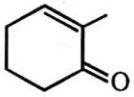
(c) 

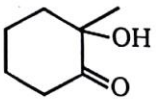
(d) 

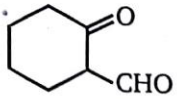
106. 

Product (*C*) of the reaction is:

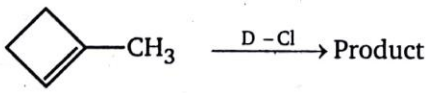
(a) 

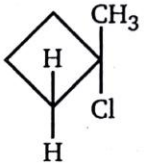
(b) 

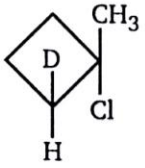
(c) 

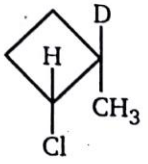
(d) 

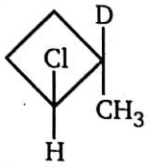
107. What is the major product expected from the following reaction ?



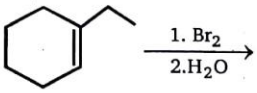
(a) 

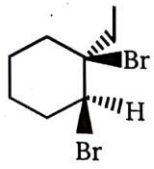
(b) 

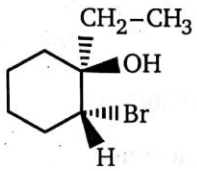
(c) 

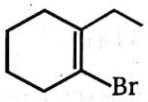
(d) 

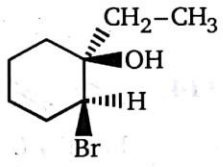
108. Choose the correct product of this reaction :

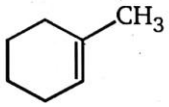


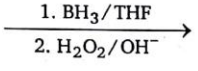
(a) 

(b) 

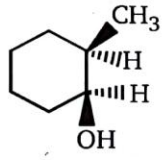
(c) 

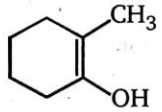
(d) 

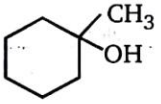
109. 

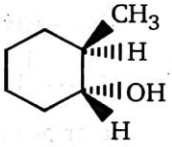


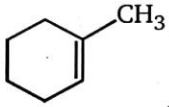
A; Product *A* is:

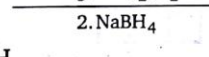
(a) 

(b) 

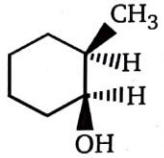
(c) 

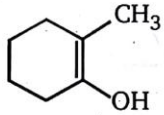
(d) 

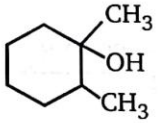
110. 

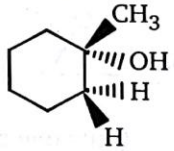


Product; Product is :

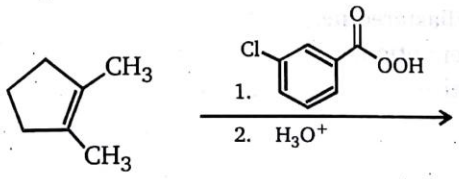
(a) 

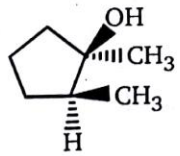
(b) 

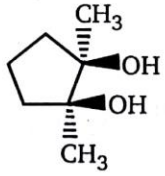
(c) 

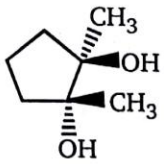
(d) 

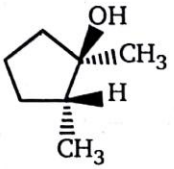
111. Choose the correct product of the following reactions :



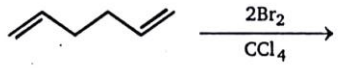
(a) 

(b) 

(c) 

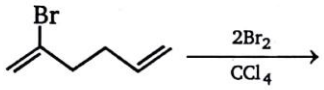
(d) 

112. How many stereoisomeric tetrabromides will be formed in the following reaction ?

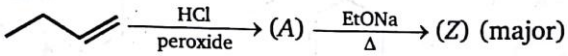


(a) 2 (b) 3 (c) 4 (d) 6

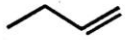
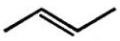
113. How many stereoisomeric pentabromides will be formed in the following reaction ?

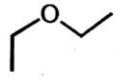


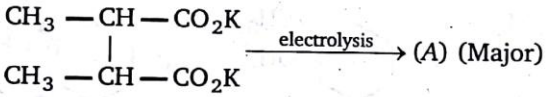
(a) 2 (b) 3
(c) 4 (d) None of these

114. 

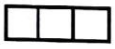
Identify (*Z*) in the above sequence of reactions :

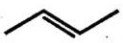
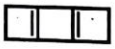
(a)  (b) 

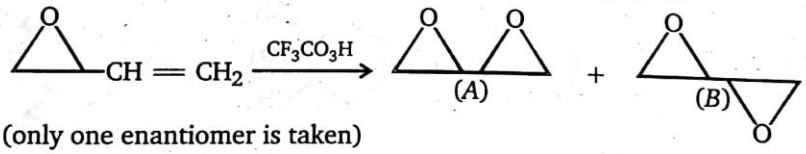
(c)  (d) 

115. 

Major product (*A*) of the above reaction :

(a)  (b) 

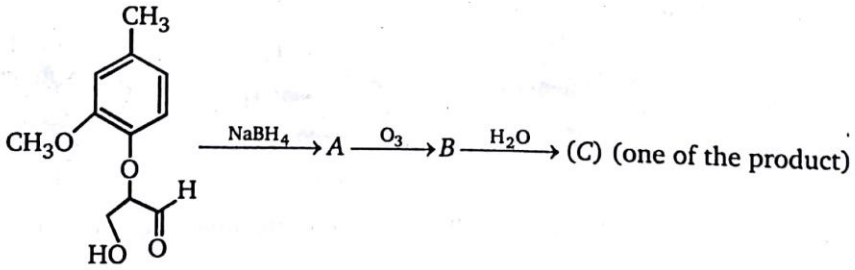
(c)  (d) 

116. 

(only one enantiomer is taken)

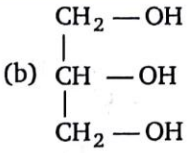
Which of the following statement is correct about *A* and *B* ?

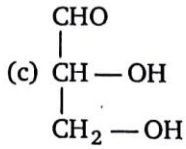
(a) *A* and *B* are mixture of diastereomers
(b) *A* and *B* are mixture of enantiomers
(c) *A* and *B* are optically active
(d) *B* is racemic mixture

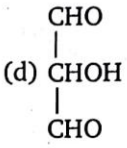
117. 

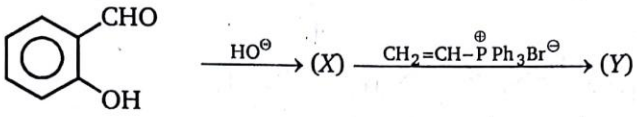
Identify the product (*C*):

(a) 

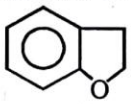
(b) 

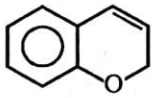
(c) 

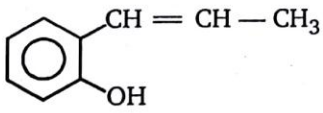
(d) 

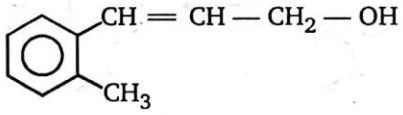
118. 

Product (*Y*) of the above reaction is :

(a) 

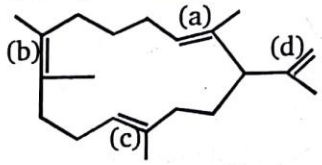
(b) 

(c) 

(d) 

119. In the reaction Me — C ≡ C — Et $\xrightarrow{Na/liq.NH_3}$ *P* $\xrightarrow[CCl_4]{Br_2}$ (*Q*) ; then *Q* is :

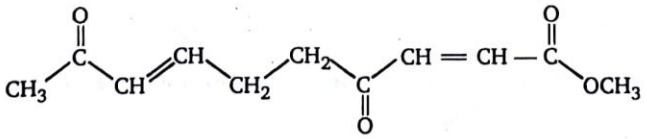
(a) A pure compound which is optically inactive due to internal compensation
(b) A binary mixture which is optically inactive due to external compensation
(c) A binary mixture which is optically active
(d) A pure compound which is optically inactive due to absence of chiral centre

120. 

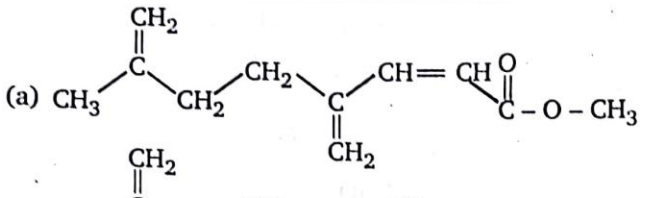
Which (π-bond) will reduce first, when above compound undergoes catalytic hydrogenation ?

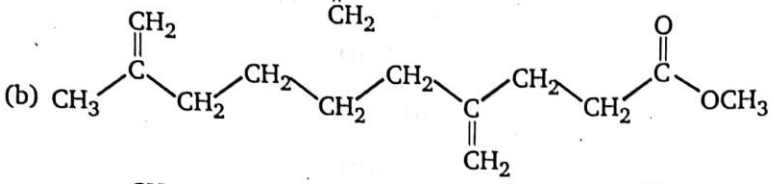
(a) *a* (b) *b* (c) *c* (d) *d*

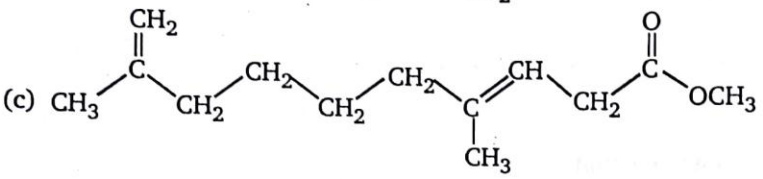
121. Compound *A*, which is a degradation product of the antibiotic vermiculine has following structure



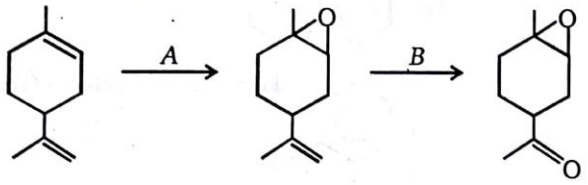
(*A*) $C_{11}H_{14}O_4$ $\xrightarrow[Pd/C]{H_2}$ (*B*) $C_{11}H_{18}O_4$ $\xleftarrow{(CH_3)_2S}$ $\xleftarrow[CH_2Cl_2]{O_3}$ (*C*) $C_{11}H_{18}O_2$. Unknown (*C*) is:

(a) 

(b) 

(c) 

(d) None of these

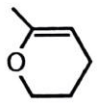
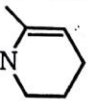
122. 

Reagent (*A*) and (*B*) in above reaction are :

(a) $A = RCO_3H$, $B = H_2O_2$ (b) $A = RCO_3H$, $B = HIO_4$

(c) $A = RCO_3H$, $B = O_3$ (d) $A = O_3$, $B = RCO_3H$

123. Rank the following in the increasing order of rate of reaction with HBr .

(*P*)  (*Q*)  (*R*) 

(a) $R > P > Q$ (b) $R > Q > P$

(c) $P > R > S$ (d) $P > S > R$

124. Select the reaction(s) that would result in the formation of 2-bromopropane.

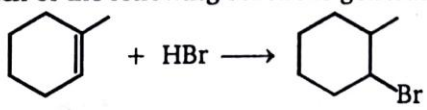
(I) $CH_3CH = CH_2 + HBr \xrightarrow{\text{peroxide}}$ (II) $CH_3CH = CH_2 + HBr \xrightarrow{CCl_4}$

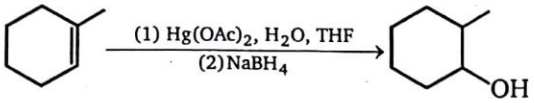
(III) $CH_3CH_2CH_3 + Br_2 \xrightarrow{h\nu}$ (IV) $CH_3CH = CH_2 + Br_2 \xrightarrow{CCl_4}$

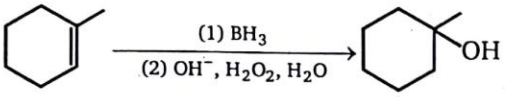
(a) I and III (b) II and III

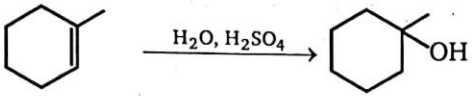
(c) I, II, and III (d) I, II and III

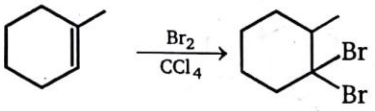
125. Which of the following reactions generates the major product ? Ignore stereoisomerism.

(a) 

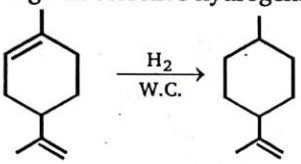
(b) 

(c) 

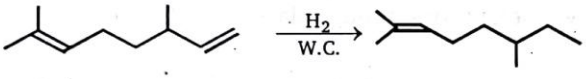
(d) 

(e) 

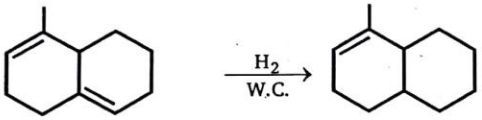
126. In the given selective hydrogenation which combination is incorrect ?

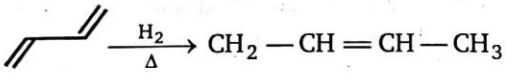
(a) 

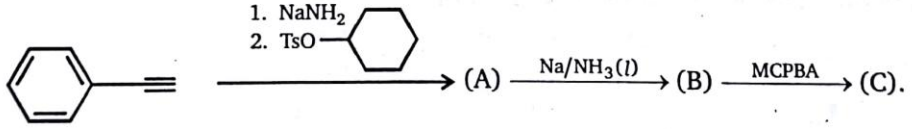
(W.C. = Wilkinsons catalyst)

(b) 

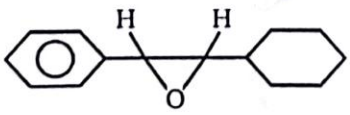
(W.C. = Wilkinsons catalyst)

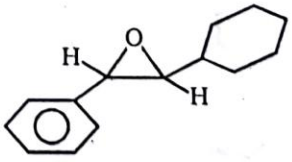
(c) 

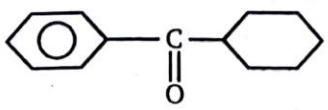
(d) 

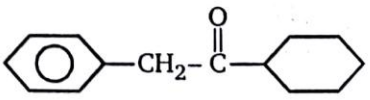
127. 

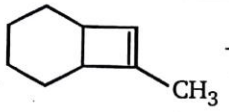
Compound (*C*) in above sequence of reaction is :

(a) 

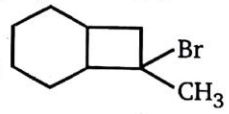
(b) 

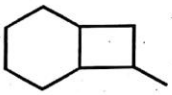
(c) 

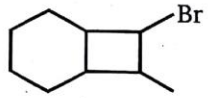
(d) 

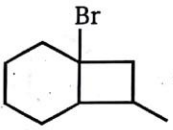
128.  $\xrightarrow[R_2O_2/h\nu]{HBr}$ (A);

Major product (A) is :

(a) 

(b) 

(c) 

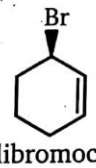
(d) 

129. In the reaction given below, the product would be :

$$CH_3-CH=CH-CH_3 \xrightarrow{H_3O^+} CH_3-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$$

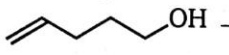
(a) a mixture of diastereomers
(b) optically active
(c) optically pure enantiomer
(d) a racemic mixture

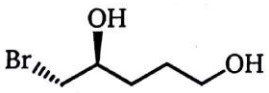
130. Surprisingly, the reaction shown below goes through classical carbocation. What is the major product of this reaction ?

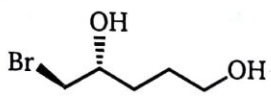
 + HBr $\longrightarrow$

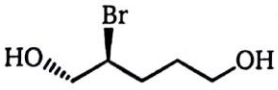
(a) *trans*-1, 3-dibromocyclohexane
(b) *cis*-1, 3-dibromocyclohexane
(c) *trans*-1, 2-dibromocyclohexane
(d) *cis*-1, 2-dibromocyclohexane

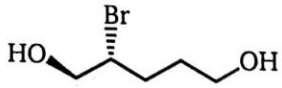
131. The major product of the reaction given below is :

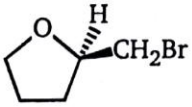
 $\xrightarrow[H_2O]{Br_2}$?

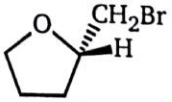
(i) 

(ii) 

(iii) 

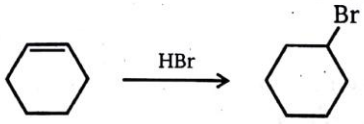
(iv) 

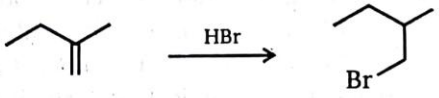
(v) 

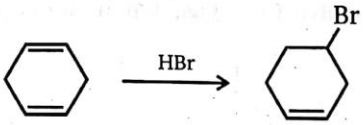
(vi) 

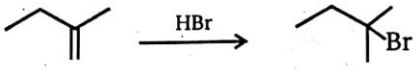
(a) (i) and (ii)
(b) (iii) and (iv)
(c) (v) and (vi)
(d) none of these

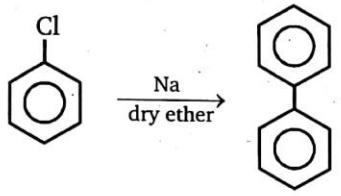
132. Which reaction will occur at the fastest rate ?

(a) 

(b) 

(c) 

(d) 

133. 

Above reaction is known as :

(a) Wurtz reaction (b) Wurtz fittig reaction

(c) Fittig reaction (d) Kolbe electrolysis

134. $CH_3—CH_2—\overset{\overset{O}{\|}}{C}—H \xrightarrow{\text{Red P + HI}} A$

Product *A* is :

(a) propane (b) propanol (c) prapanoic acid (d) propene

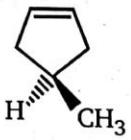
135. Which of the following compound give diastereomers when treated with Br_2 in CCl_4?

(a) 

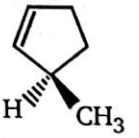
Methylcyclopentane

(b) 

1-Methylcyclopentene

(c) 

3-Methylcyclopentene

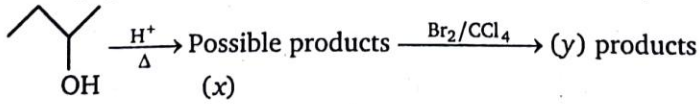
(d) 

4-Methylcyclopentene

136. A mixture of C_2H_6, C_2H_4 and C_2H_2 is bubbled through alkaline solution of copper (I) chloride, contained in Woulf's bottle. The gas coming out is :

(a) original mixture (b) C_2H_6

(c) C_2H_6 and C_2H_4 mixture (d) C_2H_4 and C_2H_2

137. 

The number of possible products for *x* and *y* is :

(a) 2, 4 (b) 3, 5

(c) 3, 6 (d) 3, 4

138. Select the incorrect statement :

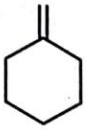
(a) Bromine is more selective and less reactive

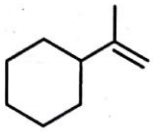
(b) Chlorine is less selective and more reactive

(c) Benzyl free radical is more stable than 2° free radical

(d) Vinyl free radical more stable than allyl free radical

139. Which of the following compound does not evolve CO_2 gas, when undergo oxidative ozonolysis ?

(a) 

(b) 

(c) $H_2C = CH - CH = CH_2$

(d) 

140. *cis*-3-hexene $\xrightarrow{(a)}$ meso 3,4-hexanediol

trans-3-hexene $\xrightarrow{(b)}$ meso 3,4-hexanediol.

Choose pair of reagent (a, b) for above conversions.

(a) Cold $KMnO_4, OsO_4$

(b) Cold $KMnO_4, RCO_3H/H_3O^{\oplus}$

(c) $RCO_3H/H_3O^{\oplus}$, cold $KMnO_4$

(d) None of these

141.  $\xrightarrow[\text{Liq. } NH_3]{Na} (A) \xrightarrow[Zn]{O_3} (B) \xrightarrow{Ph_3P=CH_2\,(2\text{mole})} (C)$

Product (C) of the above reaction is :

(a) 1,3-hexadiene

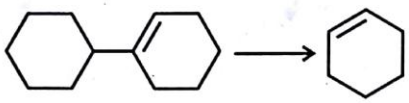
(b) 1,4-pentadiene

(c) 1,3-butadiene

(d) 1,3-heptadiene

142. How many carbon-hydrogen bond orbitals are available for overlap with the vacant *p*-orbital in ethyl carbocation ?

(a) 0 (b) 3 (c) 5 (d) 6

143. 

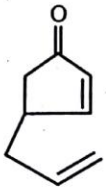
To achieve above conversion, the reagents used will be :

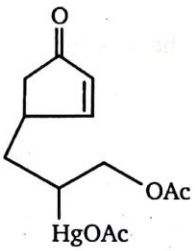
(a) O_3/H_2O_2, HO^-/Δ

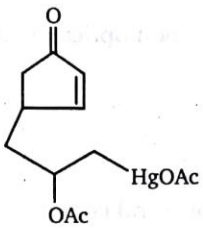
(b) HBr, alc. KOH, O_3, $LiAlH_4$, H^+/Δ

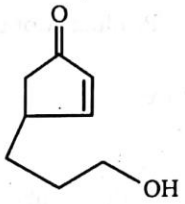
(c) HBr, *t*-BuOK, O_3, $KMnO_4$, Δ

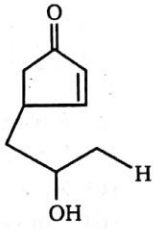
(d) HCl, $KMnO_4$ (cold), H^+/Δ

144.  $\xrightarrow[AcOH]{Hg(OAc)_2} X$ (major); Product (X) is:

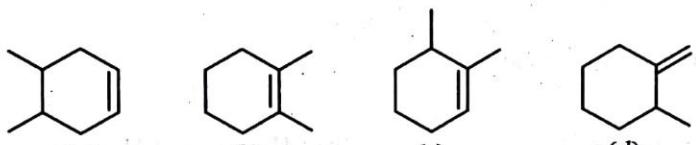
(a) 

(b) 

(c) 

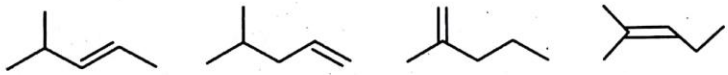
(d) 

145. Decreasing order of heat evolved upon catalytic hydrogenation of given reactants with a H_2 (Pd/C) is :



(a) $b > c > a > d$ (b) $d > a > c > b$ (c) $d > c > a > b$ (d) $c > b > c > d$

146.

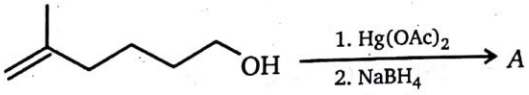


The correct order of heat of hydrogenation of given molecules is :

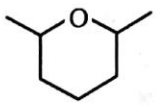
(a) $d > c > a > b$ (b) $d > c > b > a$

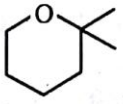
(c) $b > a > c > d$ (d) $d > a > c > b$

147.

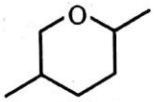


Product (*A*) of the above reaction is :

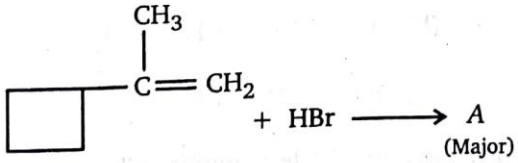
(a) 

(b) 

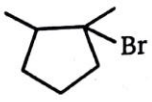
(c) 

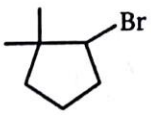
(d) 

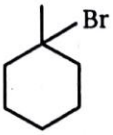
148.

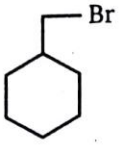


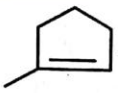
Product (*A*) is :

(a) 

(b) 

(c) 

(d) 

149.  $\xrightarrow[CCl_4]{HBr}$ Product; Comment upon optical activity of the product.

(a) Racemic mixture
(b) Diastereomers
(c) Meso
(d) Optically inactive due to absence of chiral center

150. $CH_3-\underset{}{\overset{CH_3}{\overset{|}{C}}}=CH-CH_3 \xrightarrow{Hg(OAc)_2/EtOH} \underset{(90\%)}{(A)}$

Product (*A*) of the above reaction is :

(a) $CH_3-\overset{CH_3}{\overset{|}{C}}(HgOAc)-CH(OEt)-CH_3$

(b) $CH_3-\overset{CH_3}{\overset{|}{C}}(OEt)-CH(HgOAc)-CH_3$

(c) $CH_3-\overset{CH_3}{\overset{|}{C}}(OH)-CH(HgOAc)-CH_3$

(d) $CH_3-\overset{CH_3}{\overset{|}{C}}(HgOAc)-CH(OH)-CH_3$

151. $Me_2CH-CH(OH)-Me \xrightarrow[350°C]{Al_2O_3} (A) \xrightarrow[(ii)\ AgOH]{(i)\ HI} (B)$

Product (*B*) of above reaction :

(a) $Me_2C(OH)CH_2Me$

(b) $Me_2CH-CH(OH)-Me$

(c) $Me-CH(OH)-CMe_3$

(d) $HO-CH_2-(CH_2)Me$

152. In which of the following reaction, Markownikoff's rule is violated ?

(a) $CH_3-O-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

(b) $CH_3-NH-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

(c) $CH_3-S-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

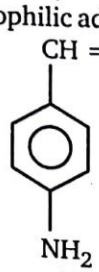
(d) $O_2N-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

153. Decreasing order of rate of reaction of molecules towards electrophilic addition reaction is :


(*a*)


(*b*)


(*c*)

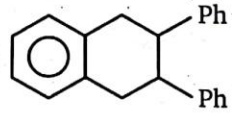

(*d*)

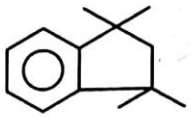
(a) $a > b > c > d$ (b) $b > c > a > d$

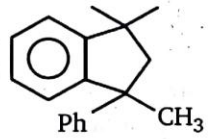
(c) $d > b > c > a$ (d) $b > d > c > a$

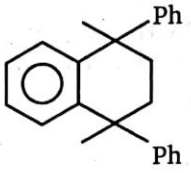
154. $2CH_3-\underset{\underset{Ph}{|}}{C}=CH_2 \xrightarrow{H\text{–}A\,(acid)} \underset{(major)}{(A)}$

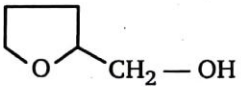
Product (*A*) is :

(a) 

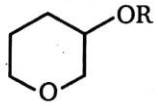
(b) 

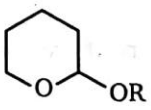
(c) 

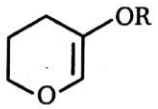
(d) 

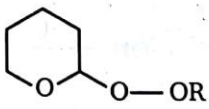
155.  $\xrightarrow[\Delta]{H^+} (A) \xrightarrow[H^{\oplus}]{ROH} \underset{(major)}{(B)}$

Product (*B*) of the above reaction is :

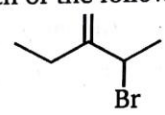
(a) 

(b) 

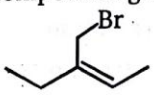
(c) 

(d) 

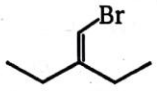
156. Which of the following compounds gives the same carbocation on ionization ?



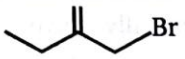
1



2



3



4

(a) 1 and 3 (b) 2 and 4

(c) 1 and 2 (d) 1 and 4

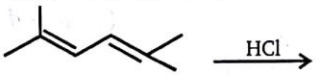
157. For the following reactions the major products are shown :

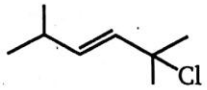
$$H_2C=CH-CH=CH_2 \xrightarrow[0°C]{HBr} H_2C=CH-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow{+\ 25°C} CH_2\underset{\underset{Br}{|}}{CH}=CHCH_3$$

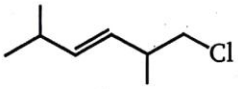
These provide an example of ___1___ control at low temperature and ___2___ control at higher temperature.

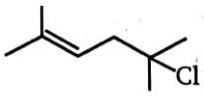
	1	2		1	2
(a)	kinetic	thermodynamic	(b)	thermodynamic	kinetic
(c)	kinetic	kinetic	(d)	thermodynamic	thermodynamic

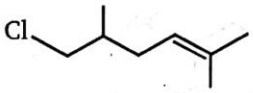
158. What is the product of 1, 4-addition in the reaction shown below ?

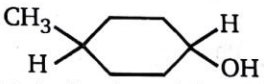


(a) 

(b) 

(c) 

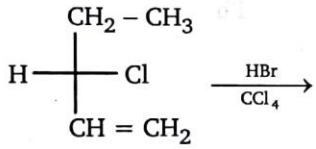
(d) 

159. 

Dehydration of the above compound will give :

(a) meso product (b) racemic mixture

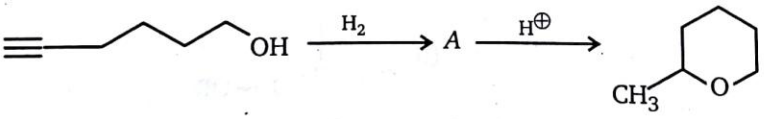
(c) diastereomer (d) optically pure enantiomer

160. 

What is stereochemistry of product ?

(a) Racemic mixture (b) Optically inactive

(c) Diastereomers (d) Meso product

161. 

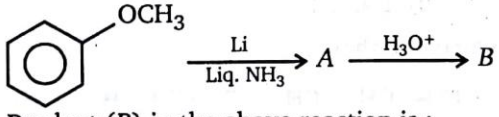
End product formed in the above reaction is :

(a) Optically active (b) Racemic (c) Meso (d) Diastereomer

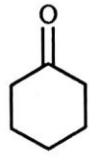
162. How many moles of BH_3 are needed to react completely with 2 mole of 1-pentene in hydroboration-oxidation reaction ?

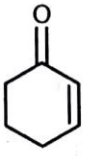
(a) 2 mole (b) 3 mole

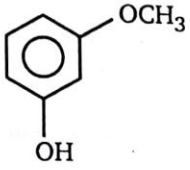
(c) 2/3 mole (d) 3/2 mole

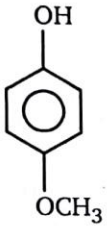
163. 

Product (*B*) in the above reaction is :

(a) 

(b) 

(c) 

(d) 

164. $H_2\overset{14}{C}=CH-CH_3 \xrightarrow[\text{or high temp}]{\text{low conc. of } Br_2} (?)$

Product of the above reaction is :

(a) $H_2\overset{14}{C}=CH-CH_2-Br$

(b) $H_2C=CH-\overset{14}{C}H_2-Br$

(c) $\overset{14}{C}H_2(Br)-CH(Br)-CH_3$

(d) both (a) and (b)

165. In which of the following reactions 1,3-butadiene will be obtained as a major product ?

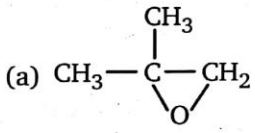
(a) $Br-CH_2-CH_2-CH_2-CH_2-Br \xrightarrow[(CH_3)_3COH]{(CH_3)_3COK\,(2\,mole)}$

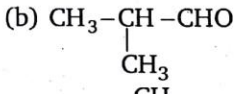
(b) $HO-CH_2-CH_2-CH_2-CH_2-OH \xrightarrow{Conc.\,H_2SO_4}$

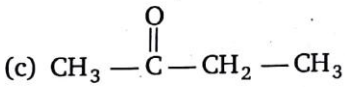
(c) $H_2C=CH-C\equiv CH \xrightarrow[Ni_2B]{H_2\,(1\,mole)}$

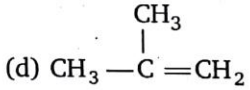
(d) All of these

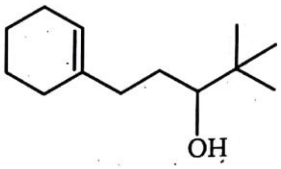
166. $H_2C=C(CH_3)(CH_3) \xrightarrow[20°C]{Cl_2} \xrightarrow[2.\,Ca(OH)_2]{1.\,H_2O} \xrightarrow[\Delta]{H^+} A$; Identify A.

(a) 

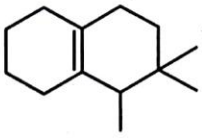
(b) 

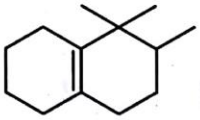
(c) 

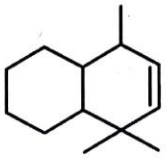
(d) 

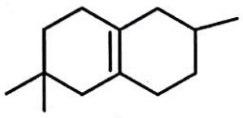
167.  $\xrightarrow[\Delta]{H_2SO_4} A$;

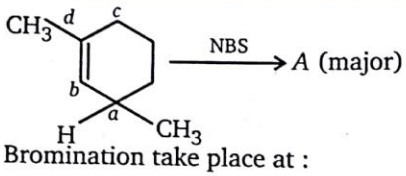
Product (A) is :

(a) 

(b) 

(c) 

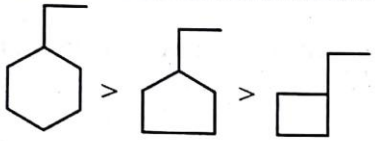
(d) 

168. 

Bromination take place at :

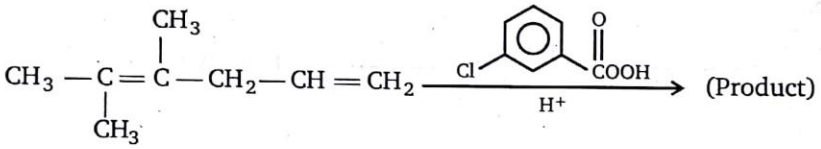
(a) a (b) b (c) c (d) d

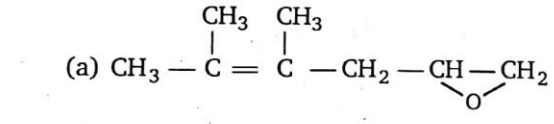
169. Which is incorrect statement about heats of combustion ?

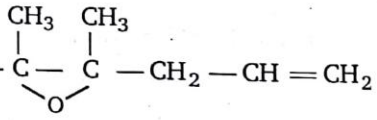
(a)  (b) 

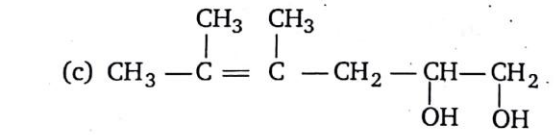
(c) Iso-butene > *trans*-2-butene > 1-butene (d) n-Hexane < n-Heptane < n-Octane

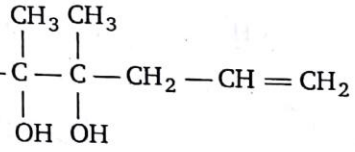
170. Predict the major product of the reaction.

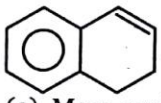


(a) 

(b) 

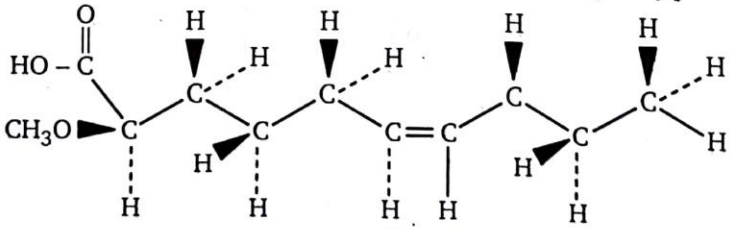
(c) 

(d) 

171.  cold dil. $KMnO_4$ → Product of the reaction is:

(a) Meso compound (b) Enantiomeric pair

(c) Diastereomers (d) Optically pure enantiomer

172. 

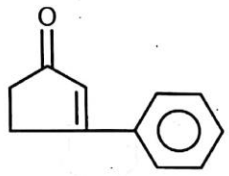
Product (*A*) of above reaction is:

(a) $CH_3O-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CH_2-CHO$

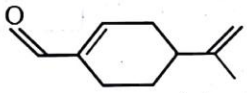
(b) $CH_3O-CH_2-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CO_2H$

(c) $CH_3O-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CH_2-CO_2H$

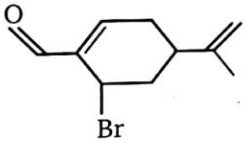
(d) $CH_3O-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CH_2-CH_2-CHO$

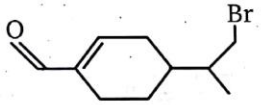
173.  $\xrightarrow[10\%\,Pd/C]{H_2\ (2\text{-}3atm)(1\ mole)}$ Products ; Comment up on optical activity of products.

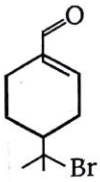
(a) Diastereomers (b) Racemic mixture (c) Meso (d) Optically pure enantiomer

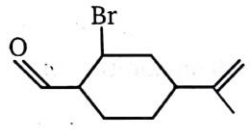
174.  $+\ HBr$ (1 mole) $\longrightarrow$ Product

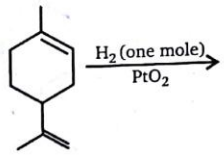
Addition of a mineral acid to an olefin bond leads to major product, Identify it:

(a) 

(b) 

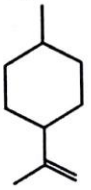
(c) 

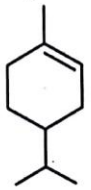
(d) 

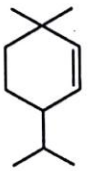
175. 

Product

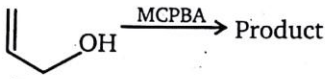
In polyenes that contain differently substituted (C=C) double bonds, it is possible to hydrogenate chemeselectively one (C=C) double bond. Product is :

(a) 

(b) 

(c) 

(d) 

176. 

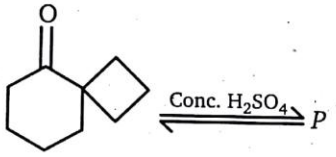
(MCPBA ⟶ meta-chloro perbenzoic acid)

Stereochemistry of the product of above reaction is :

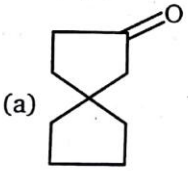
(a) Meso (b) Racemic

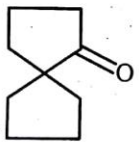
(c) Diastereomers

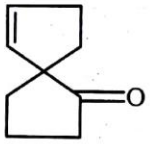
(d) Optically inactive due to absence of chiral center.

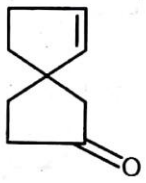
177. 

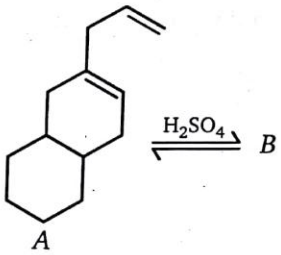
Identify product (*P*).

(a) 

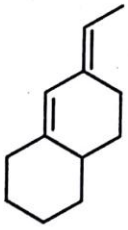
(b) 

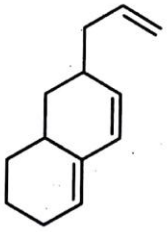
(c) 

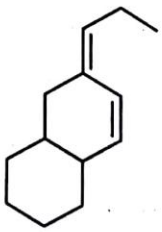
(d) 

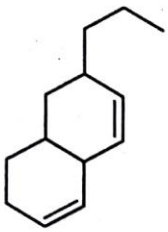
178. 

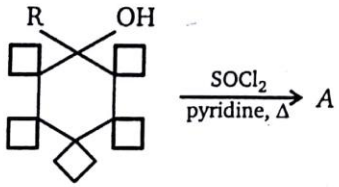
A isomerise to *B* on addition of traces of acid H_2SO_4. Compound (*B*) is :

(a) 

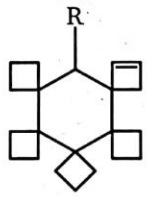
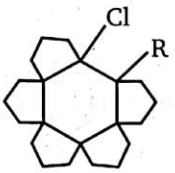
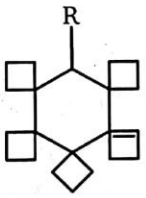
(b) 

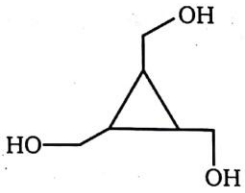
(c) 

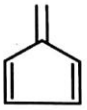
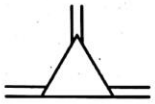
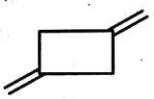
(d) 

179. 

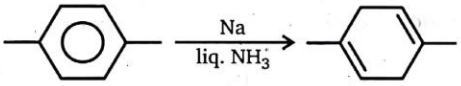
Product (*A*) of the reaction is :

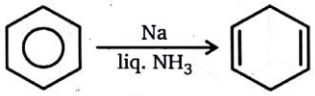
(a)  (b)  (c)  (d) None of these

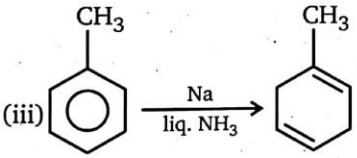
180.  $\xrightarrow[\Delta]{H^+ \text{ (excess)}}$ (*A*). Product (*A*) is :

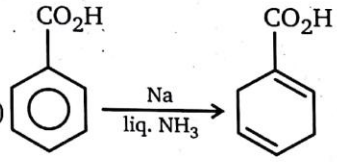
(a)  (b)  (c)  (d) 

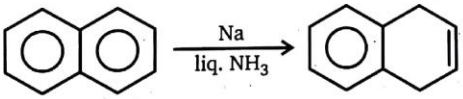
181. Which of the following reactions do not represent the major product of given Birch reductions ?

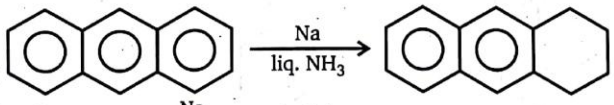
(i) 

(ii) 

(iii) 

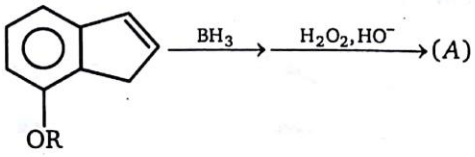
(iv) 

(v) 

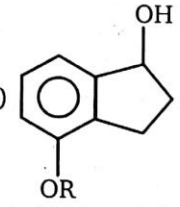
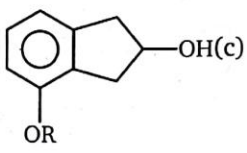
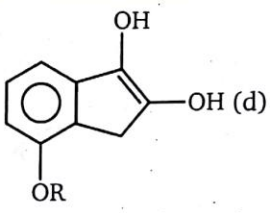
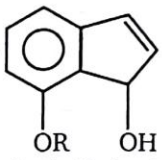
(vi) 

(vii) 2-butyne $\xrightarrow[\text{liq. } NH_3]{Na}$ *cis*-2-butene

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

182. 

Product (*A*) is:

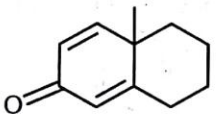
(a)  (b)  (c)  (d) 

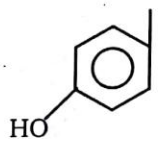
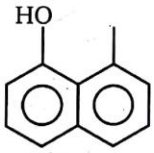
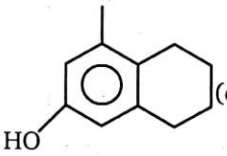
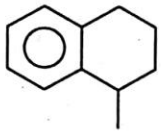
Hint : Think carefully about the relative stabilization of developing positive charge, when the double bond reacts with an electrophile.

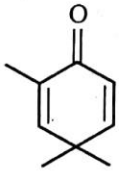
183.  $\xrightarrow{HOCl}$ (A) $\xrightarrow[25°C]{NaOH,\ H_2O}$ (B) 70%

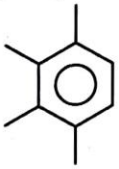
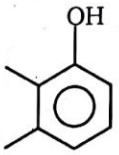
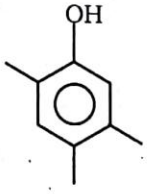
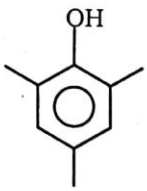
Correct statement about above reaction is:

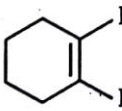
(a) A = *cis*-2-chlorocyclohexanol, B = cyclohexeneoxide
(b) A = *trans*-2-chloro cyclohexanol, B = anti-diol
(c) A = *trans*-2-chlorocyclohexanol, B = cyclohexeneoxide
(d) A = *cis*-2-chlorocyclohexanol, B = anti-diol

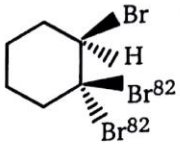
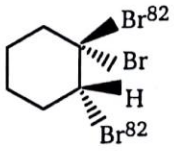
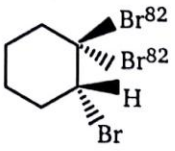
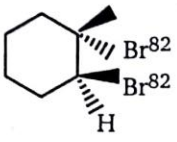
184.  $\xrightarrow{H^{\oplus}}$ Predict the major product:

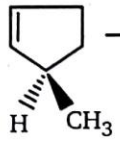
(a)  (b)  (c)  (d) 

185.  $\xrightarrow[(Major)]{H_2SO_4}$ (A) ; Product (A) is :

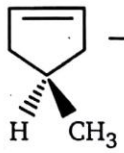
(a)  (b)  (c)  (d) 

186.  $^{82}Br - {}^{82}Br \xrightarrow{CCl_4}$ Major product of the reaction is :

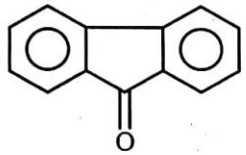
(a)  (b)  (c)  (d) 

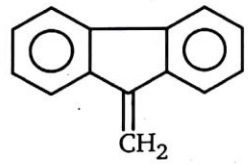
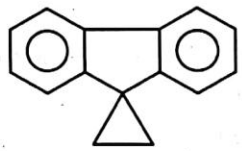
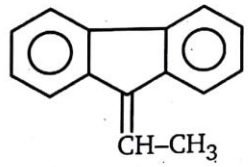
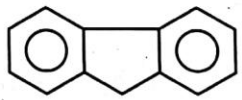
187.  $\xrightarrow[CCl_4]{Br_2}$ stereochemistry of the product is:

(a) Diastereomers
(b) Racemic mixture
(c) Meso
(d) Pure Enantiomers

188.  $\xrightarrow[CCl_4]{Br_2}$ Product/s obtained is/are :

(a) Diastereomers
(b) Racemic
(c) Meso
(d) Optically pure enantiomers

189.  $\xrightarrow{Ph_3P=CH_2}$ $\xrightarrow{Ph_3P=CH_2}$ (x) ; Product (x) is :

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

190. $CH_3-CH_2-CH_2-CH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-OH \xrightarrow[\Delta]{H^+} \underset{\text{(major)}}{(A)}$; Product (A) is :

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

(b) $CH_3-CH_2-CH_2-CH_2-CH=C\begin{matrix}CH_3\\CH_3\end{matrix}$

(c) $CH_3-CH_2-CH_2-CH_2-\underset{\underset{CH_3}{|}}{C}=CH_2$

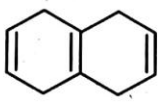
(d) $CH_3-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_2-\overset{\overset{CH_3}{|}}{C}=CH_2$

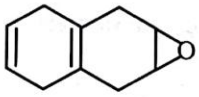
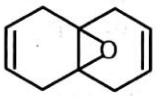
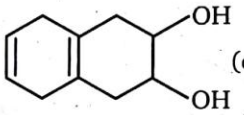
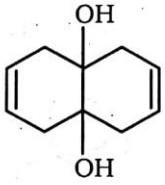
191. $CH_3-CH=CH-CH_3 \xrightarrow[R_2O_2,\Delta]{HBr}$ (Anti–Markownikoff's addition)

Comment on optical activity of the products:

(a) Racemic (b) Diastereomer

(c) Meso (d) Optically pure enantiomer

192.  $\xrightarrow{CH_3-\overset{O}{\overset{\|}{C}}-O-O-H}$ (*A*) ; (major) Product (*A*) is :

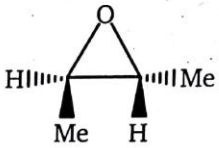
(a)  (b)  (c)  (d) 

193. *A* (alkene) → (RCO_3H, H_2O) → Racemic mixture; → (Cold dil. $KMnO_4$) → Meso-compound

Alkene (A) will be :

(a) *cis*-2-pentene (b) *cis*-2-hexene

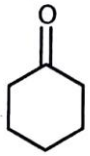
(c) *cis*-4-octene (d) *trans*-2-hexene

194.  $+ PPh_3 \longrightarrow$ (*A*) (major) $+ POPh_3$

Product (*A*) is

(a) *trans*-2-butane (b) *cis*-2-butene (c) 1-butene (d) Iso-butene

195. In which of the following reactions, two products will be formed other than phosphonium ylide ($POPh_3$)

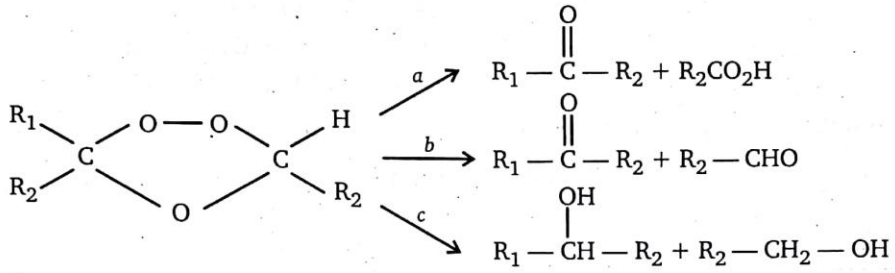
(a)  $+ Ph_3P=CH_2 \longrightarrow$

(b) $CH_3CHO + Ph_3P=\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}-CH_3 \longrightarrow$

(c) $Ph-\overset{O}{\overset{\|}{C}}-H + Ph_3P=CH-Ph \longrightarrow$

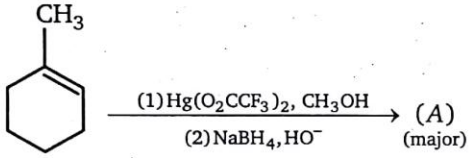
(d) $H-\overset{O}{\overset{\|}{C}}-H + Ph_3P=CH-CH_3 \longrightarrow$

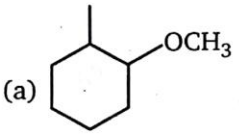
196. To carry out the given conversions, select the correct option:

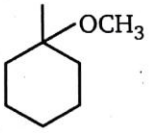


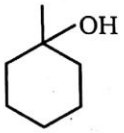
(a) $a = Ag_2O$, $b = Zn/CH_3CO_2H$, $c = LiAlH_4$
(b) $a = H_2O_2$, $b = CH_3 - S - CH_3$, $c = NaBH_4$
(c) Both (a) and (b)
(d) None of these

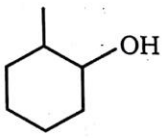
197. The product (*A*) of given alkoxymercuration de-mercuration is :

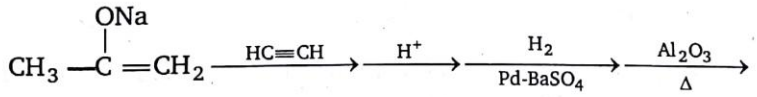


(a) 

(b) 

(c) 

(d) 

198. 

End product of the reaction is :

(a) $H_2C = CH - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} = CH_2$
(b) $CH_3 - CH = CH - CH = CH_2$
(c) $H_2C = CH - CH = CH_2$
(d) $H_2C = CH - CH_2 - CH = CH_2$

199. Major product of the given reaction is :

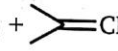
$$H_2C = CH - CH_2 - I \xrightarrow[CCl_4]{HI\,(excess)}$$

(a) $CH_3 - \underset{\displaystyle I}{\overset{\displaystyle |}{CH}} - \underset{\displaystyle I}{\overset{\displaystyle |}{CH_2}}$
(b) $CH_3 - \underset{\displaystyle I}{\overset{\displaystyle |}{CH}} - CH_3$
(c) $CH_3 - CH_2 - CH_2 - I$
(d) $I - CH_2 - CdH_2 - CH_2 - I$

200. The rate constant for a reaction can be increased by *a* the stability of the reactant or by *b* the stability of the transition state. Select the correct choice for *a* and *b*.

(a) decreasing, decreasing
(b) increasing, decreasing
(c) decreasing, increasing
(d) increasing, increasing

201. Major product of the given reaction is :

$H_2C=CH_2 +$  $\xrightarrow[\Delta]{H^+}$ Product

(a) 

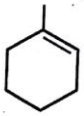
(b) 

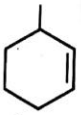
(c) 

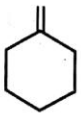
(d) $H_2C=C(CH_3)-CH_2-CH_2-CH_3$

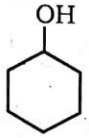
202.  $+ Ph_3P=CH_2 \longrightarrow$ (*A*) Major

Major product (*A*) is :

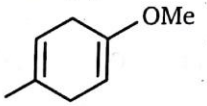
(a) 

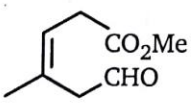
(b) 

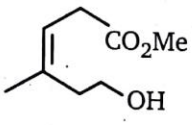
(c) 

(d) 

203. In the given reaction, only one alkene undergo preferential oxidation by electrophilic ozone. Identify product (*P*) of the given reaction:

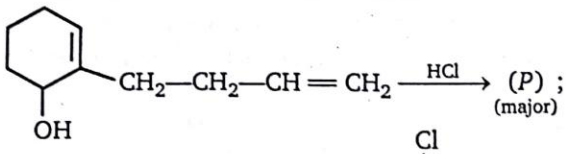
 $\xrightarrow[Me_2S,\ -78°C \text{ then } NaBH_4]{O_3}$ (*P*) (>52%)

(a) 

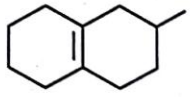
(b) 

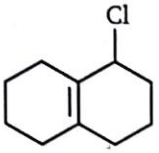
(c) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH=\underset{OMe}{\overset{|}{C}}-CH_2-CHO$

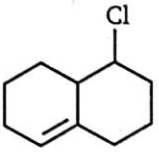
(d) $CH_3-\underset{OH}{\overset{|}{CH}}-CH_2-CH=\underset{OMe}{\overset{|}{C}}-CH_2-CH_2-OH$

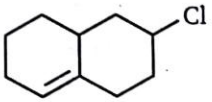
204. 

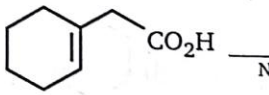
; Product (*P*) is:

(a) 

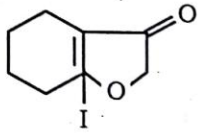
(b) 

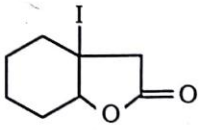
(c) 

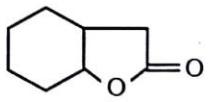
(d) 

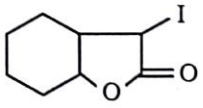
205. 

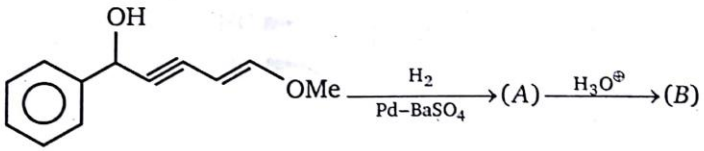
(*A*) ; Major product of the reaction is :

(a) 

(b) 

(c) 

(d) 

206. 

Product (*B*) is :

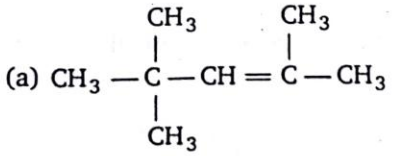
(a) 

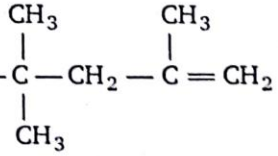
(b) Ph – CH = CH – CHO

(c) Ph – (CH = CH)$_2$ – CHO

(d) Ph – (CH = CH)$_3$ – CHO

207. Isobutene, in the presence of H_2SO_4, forms a mixture of two isomeric alkene (C_8H_{16}). The major alkene is :

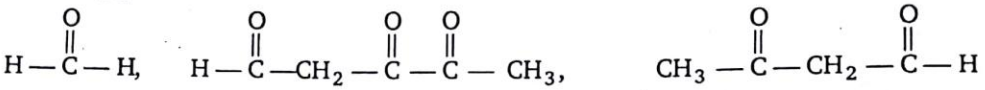
(a) 

(b) 

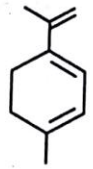
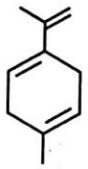
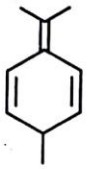
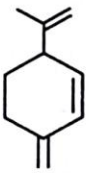
(c) 

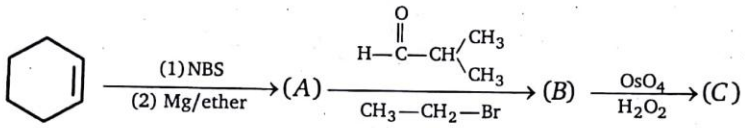
(d) 

208. An unknown alkene (*A*) reacts with 3 mole of H_2 gas in presence of platinum catalyst to form 1-isopropyl-4-methyl cyclohexane. When unknown alkene (*A*) is ozonized and reduced, following product are obtained

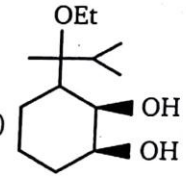
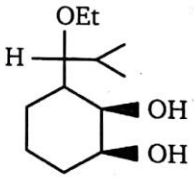
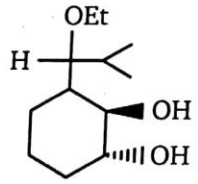


The alkene (*A*) is :

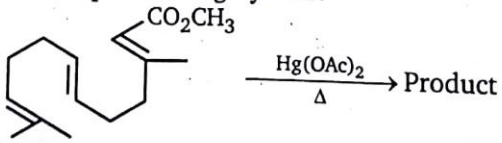
(a) 
(b) 
(c) 
(d) 

209. 

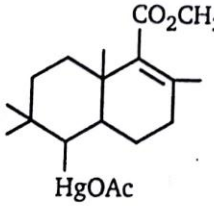
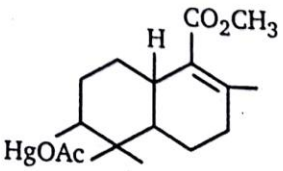
Product (*C*) is

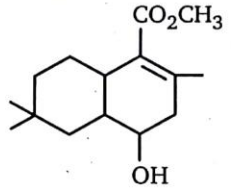
(a) 
(b) 
(c) 
(d) Both (a) and (b)

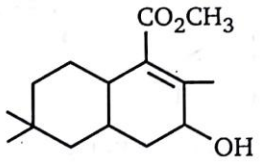
210. The following reaction take place in high yields.

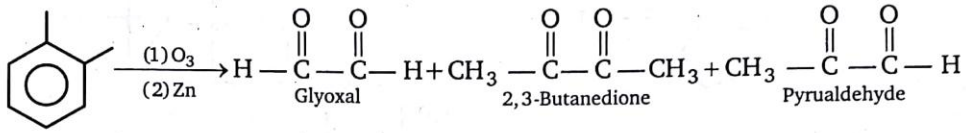


Use your knowledge of alkene chemistry to predict a product even though you have never seen this reaction before

(a) 
(b) 

(c) 

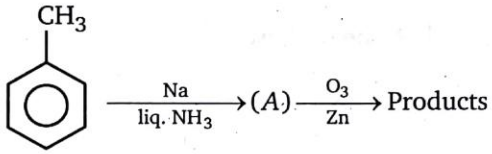
(d) 

211. 

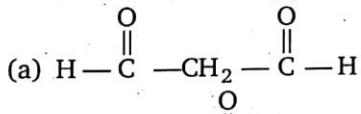
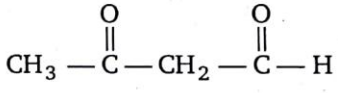
What is the ratio of glyoxal to pyrualdehyde obtained in the above reaction ?

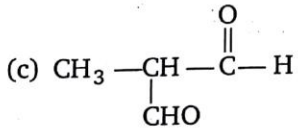
(a) 1 : 3 (b) 3 : 1

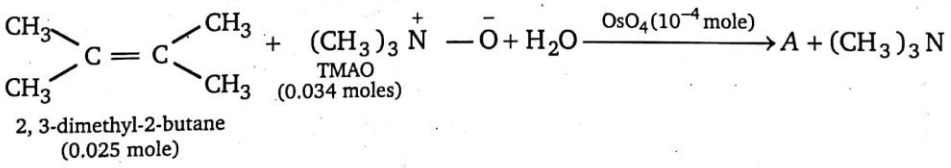
(c) 3 : 2 (d) 2 : 3

212. 

Which of the following product cannot be obtained in above reaction ?

(a)  (b) 

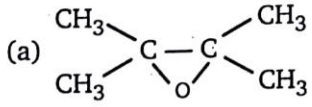
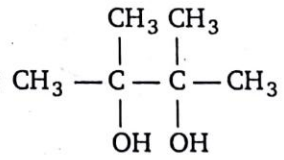
(c)  (d) None of these

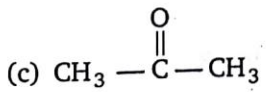
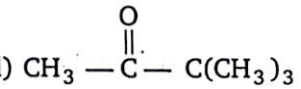
213. 

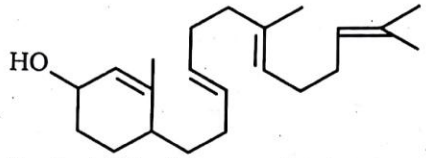
2, 3-dimethyl-2-butane (0.025 mole)

(TMAO → trimethyl amine –N – oxide)

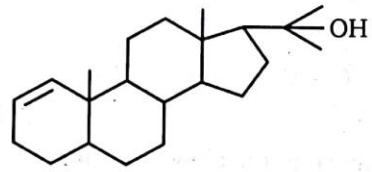
Product (*A*) is :

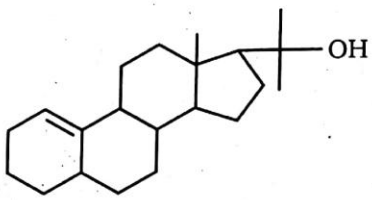
(a)  (b) 

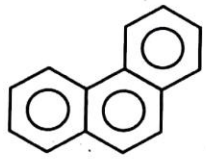
(c)  (d) 

214. 

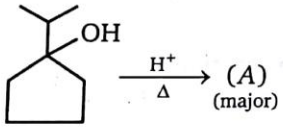
Product (*A*) of the reaction is :

(a) 

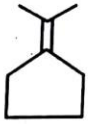
(b) 

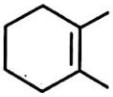
(c) 

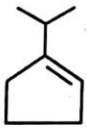
(d) None of these

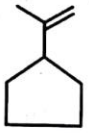
215. 

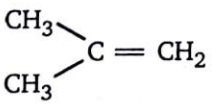
Product (*A*) is :

(a) 

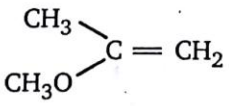
(b) 

(c) 

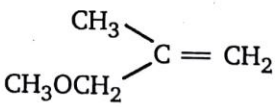
(d) 

216. 

(*a*)



(*b*)



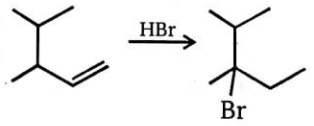
(*c*)

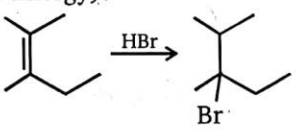
Arrange the above in the decreasing order of reactivity towards HBr :

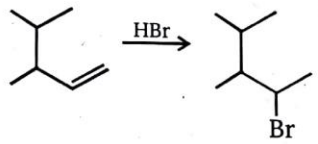
(a) $a > b > c$ (b) $b > a > c$

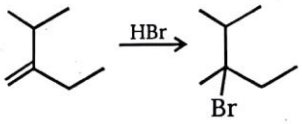
(c) $b > c > a$ (d) $a > c > b$

217. Which reaction has the lowest $\Delta G^{\ddagger}$ or (Activation-Energy)?

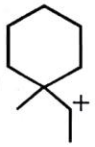
(a) 

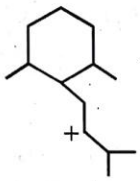
(b) 

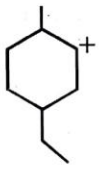
(c) 

(d) 

218. Which of the following will rearrange ?

(1) 

(2) 

(3) 

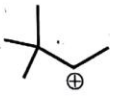
(4) 

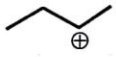
(a) 1 (b) 1 and 3

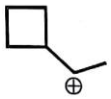
(c) All (d) 1, 2, 4,

219. Which of the following is most likely to undergo a favorable hydride shift ?

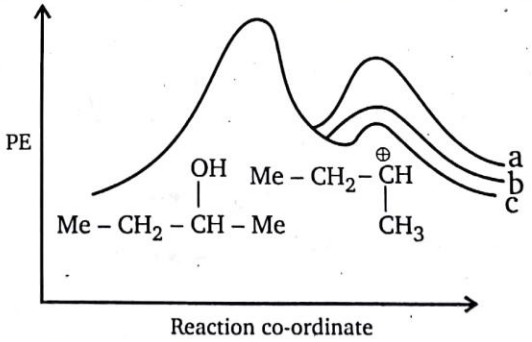
(a) 

(b) 

(c) 

(d) 

220. Energy profile diagram for dehydration of 2-butanol using conc. H_2SO_4 is given below :



Product (b) of above reaction is :

(a) 1-butene (b) *cis*-2-butene

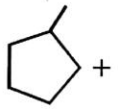
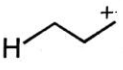
(c) *trans*-2-butene (d) *iso*-butene

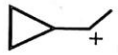
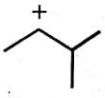
221. How many alkene on catalytic hydrogenation given isopentane as a product ?

(a) 2 (b) 3

(c) 4 (d) 5

222. Which of the following would not rearrange to a more stable form ?

(a)  (b) 

(c)  (d) 

223. Consider the following reaction.

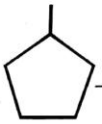
$$BrCH_2CH_2F + SbF_5 \xrightarrow[-60°C]{SO_2} CH_2 - CH_2^+ + SbF_6^-$$

(Br)

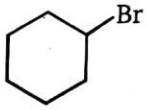
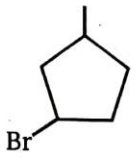
In this reaction SbF_5 acts as:

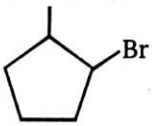
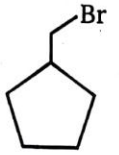
(a) an acid (b) a base

(c) a nucleophile (d) an electrophile

224.  $\xrightarrow{Br_2/hv}$ Major (X) $\xrightarrow[KOH/\Delta]{\text{Alcoholic}}$ Major(Y) $\xrightarrow[\text{Peroxide}]{H-Br}$ Major(Z):

Product (Z) is:

(a)  (b) 

(c)  (d) 

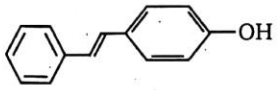
225. $CH_3-C\equiv C-H \xrightarrow{NaNH_2} \xrightarrow{CH_3-I} (A) \xrightarrow[\text{liq } NH_3]{Li} (B)$, $(A) \xrightarrow[Pd\text{-}CaCO_3]{H_2} (C)$

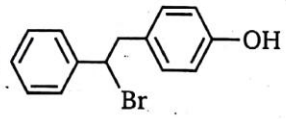
Relation between (B) and (C) is:

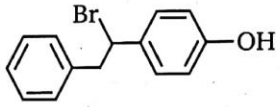
(a) Enantiomer (b) Diastereomer

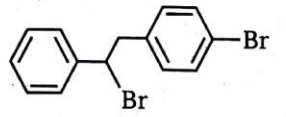
(c) Geometrical isomer (d) Meso

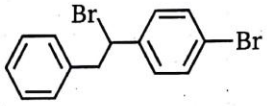
226. The reaction of HBr with the following compound would produce :

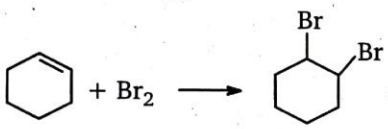


(a) 

(b) 

(c) 

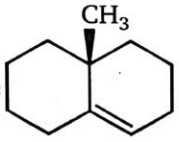
(d) 

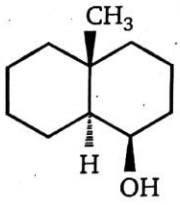
227.  is an example of:

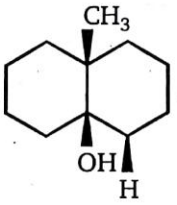
(a) Nucleophilic addition
(b) Nucleophilic substitution
(c) Electrophilic addition
(d) Electrophilic substitution
(e) Free radical substitution

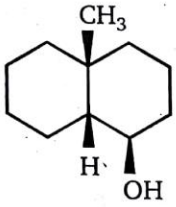
228. Olefins can be hydrogenated by :

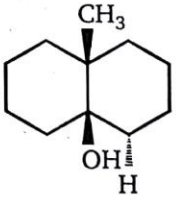
(a) Zinc and HCl
(b) Nascent hydrogen
(c) Raney Ni and H
(d) Lithium hydride in ether

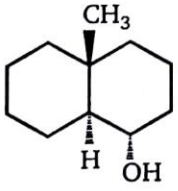
229. What are the products obtained on hydroboration-oxidation of the given alkene 

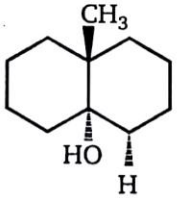
(I) 

(II) 

(III) 

(IV) 

(V) 

(VI) 

(a) I and III
(b) II and IV
(c) II and VI
(d) III and V

ANSWERS — LEVEL 1

1.	(c)	**2.**	(d)	**3.**	(c)	**4.**	(d)	**5.**	(b)	**6.**	(b)	**7.**	(c)	**8.**	(c)
9.	(c)	**10.**	(d)	**11.**	(b)	**12.**	(d)	**13.**	(c)	**14.**	(b)	**15.**	(b)	**16.**	(c)
17.	(d)	**18.**	(d)	**19.**	(b)	**20.**	(d)	**21.**	(b)	**22.**	(a)	**23.**	(b)	**24.**	(b)
25.	(b)	**26.**	(b)	**27.**	(d)	**28.**	(b)	**29.**	(d)	**30.**	(b)	**31.**	(c)	**32.**	(b)
33.	(a)	**34.**	(b)	**35.**	(b)	**36.**	(b)	**37.**	(b)	**38.**	(b)	**39.**	(b)	**40.**	(b)
41.	(d)	**42.**	(e)	**43.**	(c)	**44.**	(c)	**45.**	(a)	**46.**	(c)	**47.**	(c)	**48.**	(b)
49.	(b)	**50.**	(b)	**51.**	(b)	**52.**	(a)	**53.**	(b)	**54.**	(d)	**55.**	(b)	**56.**	(c)
57.	(c)	**58.**	(b)	**59.**	(c)	**60.**	(a)	**61.**	(b)	**62.**	(d)	**63.**	(a)	**64.**	(b)
65.	(d)	**66.**	(b)	**67.**	(d)	**68.**	(a)	**69.**	(c)	**70.**	(d)	**71.**	(d)	**72.**	(c)
73.	(d)	**74.**	(c)	**75.**	(a)	**76.**	(c)	**77.**	(d)	**78.**	(b)	**79.**	(d)	**80.**	(d)
81.	(c)	**82.**	(b)	**83.**	(a)	**84.**	(a)	**85.**	(a)	**86.**	(d)	**87.**	(b)	**88.**	(b)
89.	(c)	**90.**	(d)	**91.**	(b)	**92.**	(b)	**93.**	(a)	**94.**	(a)	**95.**	(a)	**96.**	(d)
97.	(b)	**98.**	(a)	**99.**	(c)	**100.**	(d)	**101.**	(b)	**102.**	(b)	**103.**	(d)	**104.**	(b)
105.	(b)	**106.**	(c)	**107.**	(b)	**108.**	(b)	**109.**	(d)	**110.**	(d)	**111.**	(c)	**112.**	(b)
113.	(a)	**114.**	(b)	**115.**	(c)	**116.**	(a)	**117.**	(b)	**118.**	(b)	**119.**	(b)	**120.**	(d)
121.	(b)	**122.**	(c)	**123.**	(a)	**124.**	(b)	**125.**	(d)	**126.**	(a)	**127.**	(b)	**128.**	(c)
129.	(d)	**130.**	(a)	**131.**	(c)	**132.**	(d)	**133.**	(c)	**134.**	(a)	**135.**	(d)	**136.**	(c)
137.	(b)	**138.**	(d)	**139.**	(d)	**140.**	(b)	**141.**	(b)	**142.**	(b)	**143.**	(b)	**144.**	(b)
145.	(b)	**146.**	(c)	**147.**	(b)	**148.**	(a)	**149.**	(d)	**150.**	(b)	**151.**	(a)	**152.**	(d)
153.	(c)	**154.**	(c)	**155.**	(b)	**156.**	(c)	**157.**	(a)	**158.**	(a)	**159.**	(b)	**160.**	(c)
161.	(b)	**162.**	(c)	**163**	(b)	**164.**	(d)	**165.**	(d)	**166.**	(b)	**167.**	(b)	**168.**	(a)
169.	(c)	**170.**	(b)	**171.**	(b)	**172.**	(d)	**173.**	(b)	**174.**	(c)	**175.**	(b)	**176.**	(b)
177.	(b)	**178.**	(c)	**179.**	(b)	**180.**	(c)	**181.**	(b)	**182.**	(b)	**183.**	(c)	**184.**	(c)
185.	(c)	**186.**	(b)	**187.**	(a)	**188.**	(b)	**189.**	(b)	**190.**	(b)	**191.**	(a)	**192.**	(b)
193.	(c)	**194.**	(b)	**195.**	(c)	**196.**	(c)	**197.**	(b)	**198.**	(a)	**199.**	(b)	**200.**	(c)
201.	(c)	**202.**	(c)	**203.**	(b)	**204.**	(d)	**205.**	(b)	**206.**	(c)	**207.**	(b)	**208.**	(b)
209.	(b)	**210.**	(b)	**211.**	(c)	**212.**	(c)	**213.**	(b)	**214.**	(a)	**215.**	(b)	**216.**	(b)
217.	(d)	**218.**	(c)	**219.**	(a)	**220.**	(b)	**221.**	(b)	**222.**	(c)	**223.**	(d)	**224.**	(c)
225.	(b,c)	**226.**	(b)	**227.**	(c)	**228.**	(c)	**229.**	(d)						

LEVEL-2

1.

Reagents

A. HCl	B. Br_2	C. $Hg(OAc)_2$ in H_2O	D. $B_2H_6(BH_3)$ in ether
E. H_2O_2	F. $KMnO_4$ in H_2O	G. HOBr	H. $NaBH_4$

In each reagent box write a letter designating the best reagent and condition selected from the above list of reagents.

Reactant	Reagent		Product
$(CH_3)_2CHCH=CH_2$ 3-methyl-1-butene	(i)	☐	$(CH_3)_2CHCH(Cl)CH_3$ 2-Chloro-3-methyl butane
	(ii)	☐	$(CH_3)_2CHCHBrCH_2Br$ 1,2-dibromo-3-methyl butane
	(iii)	☐	$(CH_3)_2CHCHOHCH_2Br$ 1,bromo-3-methyl 2–butanol
	(iv)	☐	$(CH_3)_2CHCH(OH)CH_3$ 3-methyl-2-butanol
	(v)	☐	$(CH_3)_2CHCH(OH)CH_2OH$ 3-methyl-1,2-butanediol

2. **Propene ($CH_3-CH=CH_2$)** can be transformed to compounds (a to j) listed in the left-hand column.

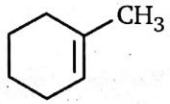
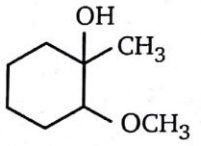
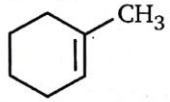
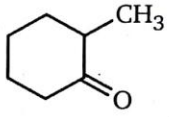
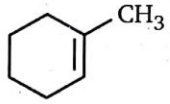
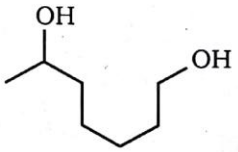
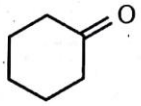
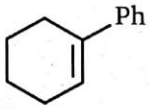
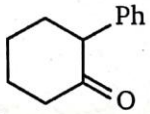
Write letter designating the reagent, you believe will achieve desired transformation. In the case of a multi step sequence write the reagent in the order they are to be used.

	Desired Product	No. of Steps	Write options		Reagent List
a.	$CH_3CHBrCH_2Br$	one		**A.**	$Hg(OAc)_2$ in H_2O
b.	$(CH_3)_2CHOH$	two		**B.**	B_2H_6 in THF

c.	$CH_3CH_2CH_2OH$	two		**C.**	$NaBH_4$ in alcohol
d.	CH_3COCH_3	three		**D.**	Br_2 in CH_2Cl_2
e.	CH_3CH_2CHO	three		**E.**	H_2O_2 in aqueous base
f.	$CH_3CH(OH)CH_2Br$	one		**F.**	HOBr (NBS in aqueous acetone)
g.	$(CH_3)_2CHBr$	one		**G.**	HBr in CH_2Cl_2
h, k.	$CH_3CH(OH)\ CH_2OH$	two		**H.**	OsO_4 in ether
i.	$CH_3-CH_2-CH_2-Cl$	three		**I.**	Thionyl chloride ($SOCl_2$)
j.	$CH_3-C\equiv CH$	two		**J.**	$NaHSO_3$ in aqueous acetone
				K.	NaOH in alcohol and reflux
				L.	$NaNH_2$ (strong base)

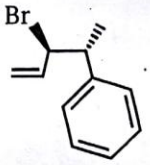
3. In each reaction box write a single letter designating the best reagent and condition selected from the list at bottom of the page.

(F.S., → first step, S.S → second step, T.S. → third step)

Reaction	Reactant	Options	Product
1.		F.S. □ → S.S. □	
2.		F.S. □ → S.S. □ T.S. □	
3.		F.S. □ → S.S. □	
4.		F.S. □ → S.S. □	
5.		F.S. □ → S.S. □ T.S. □	

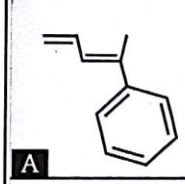
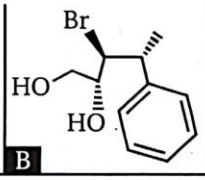
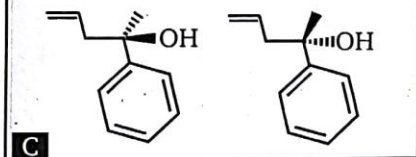
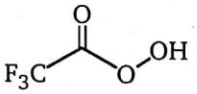
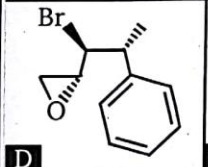
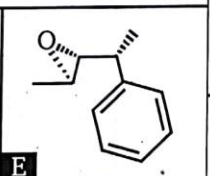
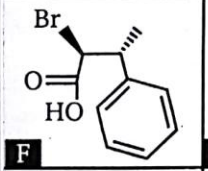
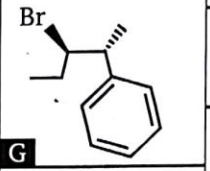
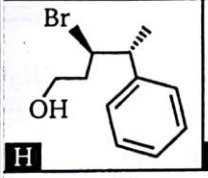
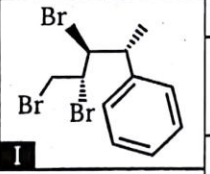
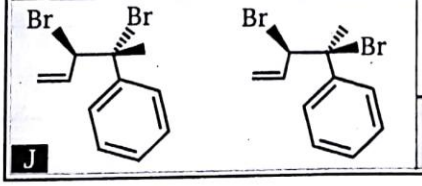
A. $NaBH_4$/alcohol	**B.** Ph $-CO_3H$/ CH_2Cl_2	**C.** PCC	**D.** CH_3ONa/CH_3OH
E. B_2H_6 in THF	**F.** H_2O_2/aq. NaOH	**G.** H_3PO_4 & heat	**H.** $AlCl_3/C_6H_6$
I. O_3 in CH_2Cl_2	**J.** Br_2in CH_2Cl_2	**K.** 20% KOH & heat	**L.** Ph – Li/ether

4. Match the reagents a-j with products A-J. There is one best product for each reaction.



(x)

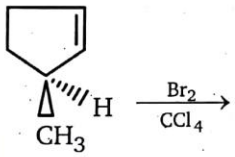
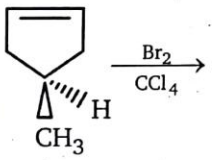
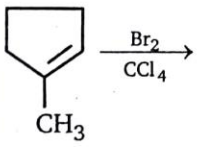
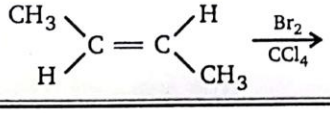
The molecule (x) is the starting material for all reactions in problem. Do the ones you know first and then tackle the rest by deductive reasoning

Products		Reagents	Option
A  B 	**(a)**	H_2O heat, pH 7	
C 	**(b)**		
D  E 	**(c)**	tBuOK, polar aprotic solvent	
F  G 	**(d)**	(1) O_3, ether (2) H_2O, NaOH, H_2O_2	
H  I 	**(e)**	Br_2, CCl_4	
J 	**(f)**	NBS, hv, CCl_4	
	(g)	(1) $H_3O(+)$ (2) NaOH, H_2O	
	(h)	(1) BH_3, ether (2) H_2O_2	
	(i)	(1) OsO_4 (2) NaOH, H_2O	
	(j)	H_2/Pd/C(EtOH)	

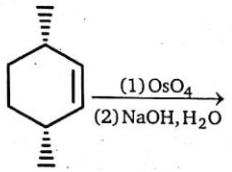
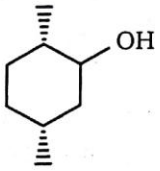
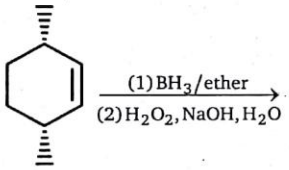
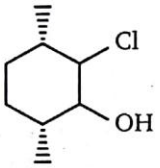
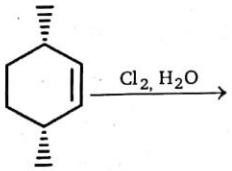
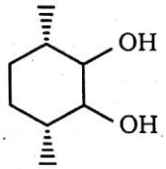
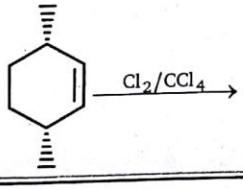
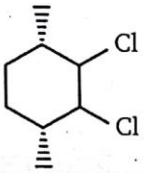
5. Match the column:

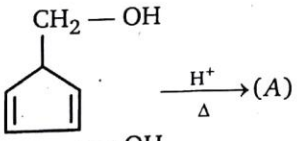
	Column (I)		Column (II)
(a)	$CH_3—C \equiv C—CH_3$	**(p)**	*cis*-product with H_2/ Pd - $BaSO_4$
(b)	$CH_3—CH_2—C \equiv CH$	**(q)**	*Trans*-product with Na/liq. NH_3
(c)	$CH_3—C \equiv CH$	**(r)**	White with amm. $AgNO_3$
(d)	$CH_3—C \equiv C—Et$	**(s)**	H_2 gas with Na

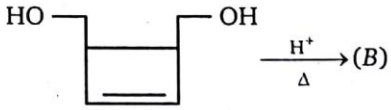
6. Match the column I with column II and with column III (Matrix).

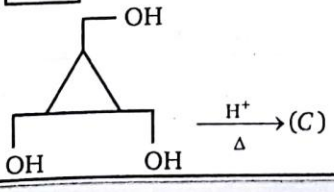
	Column-I		Column- II		Column- III	
	Reaction		Nature of product formed		Number of chiral center present in product. (Consider only one isomer in case of racemic mixture or Diastereomer)	
(a)		**(p)**	Racemic mixture	**(w)**	0	
(b)		**(q)**	Meso	**(x)**	1	
(c)		**(r)**	Diastereomer	**(y)**	2	
(d)		**(s)**	Vicinal dihalide	**(z)**	3	

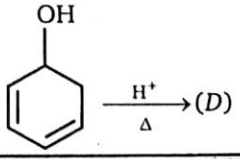
7. Match the column I and II.

Column (I)		Column (II)	
	Reaction		**Product**
(a)		**(p)**	
(b)		**(q)**	
(c)		**(r)**	
(d)		**(s)**	

8. (1) 

(2) 

(3) 

(4) 

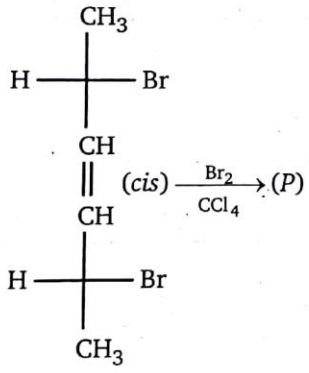
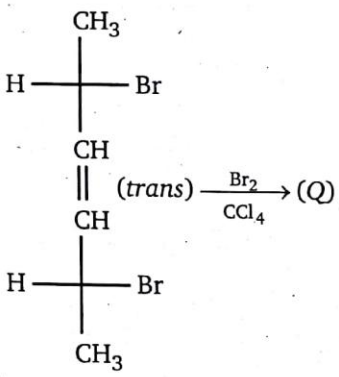
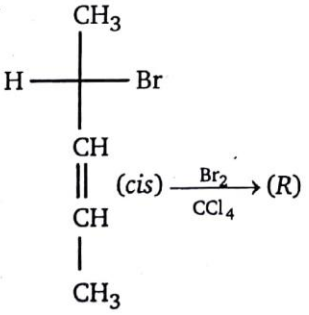
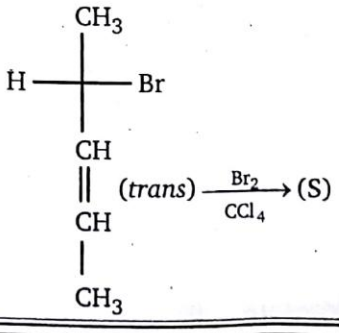
Sum of molecular mass of A, B, C, D (i.e. $A + B + C + D$) is equal to :	

9. (1) $\underset{\text{(all isomers)}}{C_2FClBrI} \xrightarrow[Ni]{H_2} (A)$ (exclude stereoisomer)

(2) $\underset{\text{(all isomers)}}{C_4H_8\,(\text{alkene})} \xrightarrow[Ni]{H_2} (B)$ (exclude stereoisomer)

Total number of products *A* and *B* (i.e. *A* + *B*) is equal to :	

10.

Reaction 1	**Reaction 2**
	
Reaction 3	**Reaction 4**
	

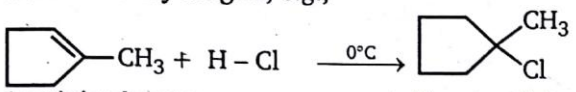
Sum of products *P*, *Q*, *R*, *S* (i.e. *P* + *Q* + *R* + *S*) is equal to :	

11. Comprehension

Vladimir Markovnikov rule :

Alkenes undergo electrophilic addition reactions. It is triggered by the acid acting as a electrophile toward π-electrons of the double bond.

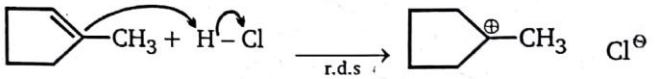
Markovnikov's rule states that when an unsymmetrically substituted alkene reacts with a hydrogen halide, the hydrogen atom adds to the carbon that has the greater number of hydrogen, e.g.,



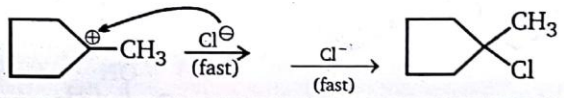
1-methyl cyclopentene — 1-chloro-1-methyl cyclopentane

Mechanism :

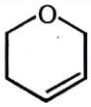
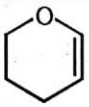
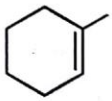
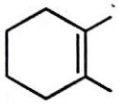
Step - 1



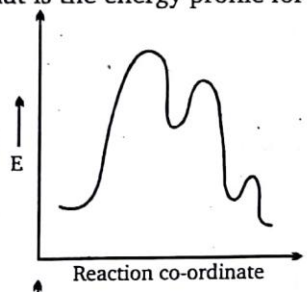
Step- 2

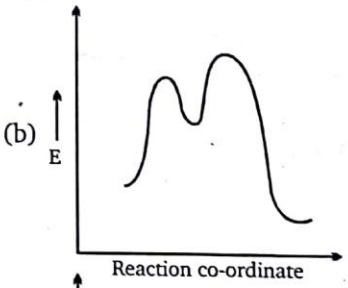


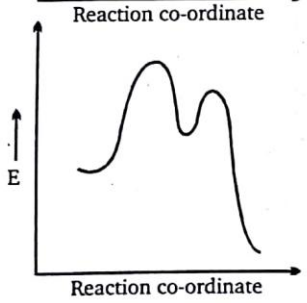
A. Which of the following is most reactive toward Markovnikov addition ?

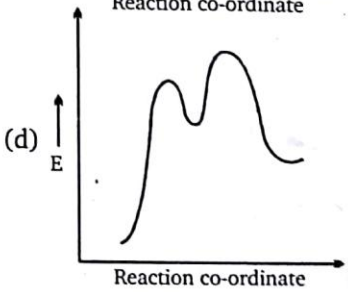
(a)  (b)  (c)  (d) 

B. What is the energy profile for the given reaction ?

(a) 

(b) 

(c) 

(d) 

C. In which of following reactions carbocation rearrangement is possible ?

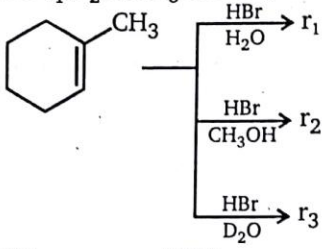
(a) $(CH_3)_2CH-CH=CH_2 \xrightarrow[0°C]{HCl}$

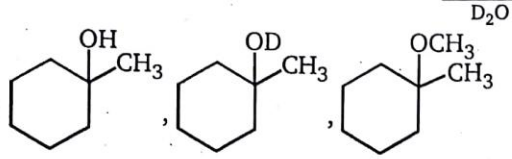
(b) $(CH_3)_3C-CH=CH_2 \xrightarrow[0°C/Cl_4]{HBr}$

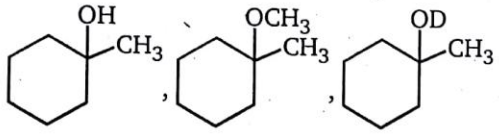
(c) $Ph-CH_2-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

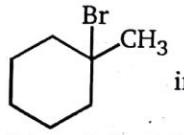
(d) All of these

D. Identify the major products r_1, r_2 and r_3 in the given reactions.

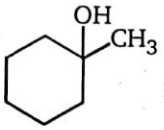


(a) 

(b) 

(c) 

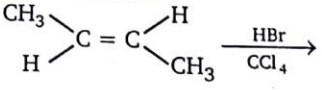
in all the reactions

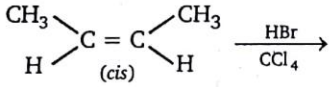
(d) 

in all the reactions

E. In which of the following reactions, product is racemic mixture ?

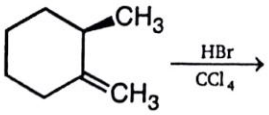
(a) $CH_3-CH_2-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

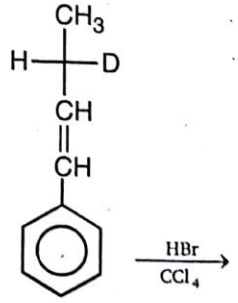
(b) 

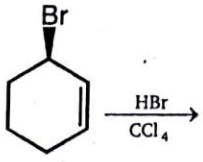
(c) 

(d) All of these

F. In which of the following reactions, diastereomers will be formed ?

(a) 

(b) 

(c) 

(d) All of these

12. Comprehension

$$CH_3-CH_2-CH=CH_2 + CH_3OH \xrightarrow{H^{\oplus}} CH_3-CH_2-\underset{\displaystyle OCH_3}{\underset{|}{CH}}-CH_3$$

Consider the above reaction and answer A to E.

A. What is electrophile in first step ?

(a) $\overset{\oplus}{C}H_3$ (b) $H^{\oplus}$

(c) $CH_3-CH_2-\overset{\oplus}{C}H-CH_3$ (d) $HO^{\oplus}$

B. What is nucleophile in first step ?

(a) CH_3OH (b) 1-butene

(c) H_2O (d) CH_3-O-CH_3

C. What is electrophile in second step ?

(a) $\overset{\oplus}{C}H_3$ (b) $H^{\oplus}$

(c) $CH_3-CH_2-\overset{\oplus}{C}H-CH_3$ (d) $CH_3-CH_2-CH_2-\overset{\oplus}{C}H_2$

D. What is nucleophile in second step ?

(a) $CH_3-CH_2-CH=CH_2$ (b) CH_3OH

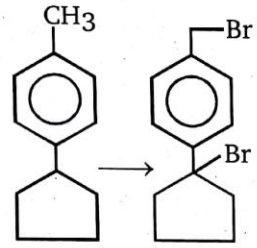
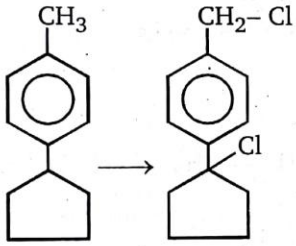
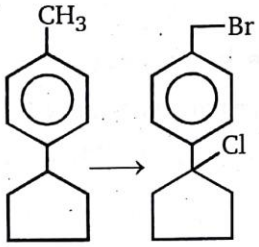
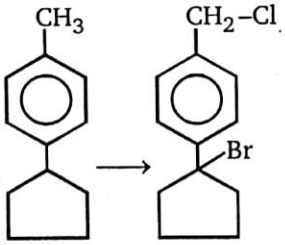
(c) H_2O (d) CH_3-O-CH_3

E. Which step is rate determining step ?

(a) attack of nucleophile CH_3OH (b) attack of electrophile $H^{\oplus}$

(c) attack of nucleophile H_2O (d) attack of electrophile $\overset{\oplus}{C}H_3$

13. Match the column I and II :

Column (I)		Column (II)	
Conversion		**Reagent**	
(a)		**(p)**	SO_2Cl_2 / *hv* (2 equivalent)
(b)		**(q)**	NBS (2 equivalent)
(c)		**(r)**	NBS then SO_2Cl_2/*hv*
(d)		**(s)**	SO_2 Cl_2 / *hv* then NBS

ANSWERS — LEVEL 2

1. (i) – A; (ii) – B; (iii) – G; (iv) – C; (v) – F

2. a – D; b – A, C; c – B, E; d – A, C, F; e – B, E, F; f – F; g – G; h – I, K; i – B, E, I; j – D, L

3. Reaction 1 : B, D; Reaction 2 : E, F, C Reaction 3 : I, A
Reaction 4 : L, G Reaction 5 : B, L, C

4. a – C; b – D; c – A; d – F; e – I; f – J; g – E; h – H; i – B; j – G

5. a – p, q; b – r, s; c – r, s; d – p, q

6. a – r, s – z; b – p, s – y; c – p, s – y; d – q, s – y

7. a – r; b – p; c – q; d – s

8. $A + B + C + D = 312$

9. $A + B = 5$

10. $P + Q + R + S = 8$

11. A – b; B – c; C – d; D – b; E – d; F – d

12. A – b; B – b; C – c; D – b; E – b

13. a-q; b-p; c-s; d-r