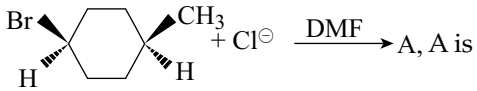
CHAPTER

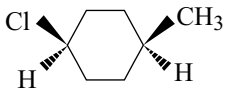
4

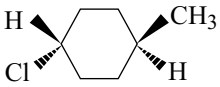
Alkyl Halides, Alcohols and Ethers

Question Bank

LEVEL 1

1. 

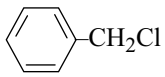
(a) 

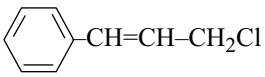
(b) 

(c) Both are correct

(d) None is correct

2. Arrange the following in the order of their reactivity of S_N2 reaction

(i) 

(ii) 

(iii) CH_2=CH–CH_2Cl

(iv) $CH_3CH_2CH_2Cl$

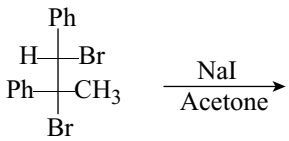
(a) iv > iii > i > ii

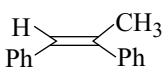
(b) ii > i > iii > iv

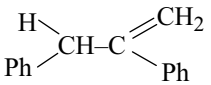
(c) i > ii > iv > iii

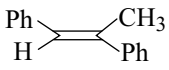
(d) iii > ii > i > iv

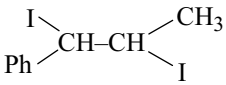
3. Identify the product of the following reaction



(a) 

(b) 

(c) 

(d) 

4. The conversion of ethanol to propanenitrite is best done by

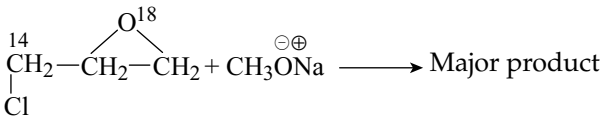
(a) $CH_3–CH_2–OH + KCN \xrightarrow{\Delta}$

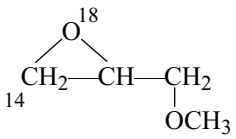
(b) $CH_3–CH_2–OH + HCN \xrightarrow{\Delta}$

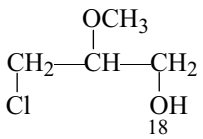
(c) $CH_3–CH_2–OH \xrightarrow[\text{(ii) KCN}]{\text{(i) TsCl/Pyridine}}$

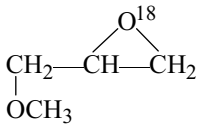
(d) $CH_3–CH_2–OH + CH_3CN \xrightarrow{\Delta}$

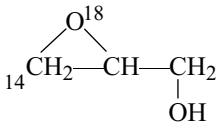
5. Major product of the following reaction is



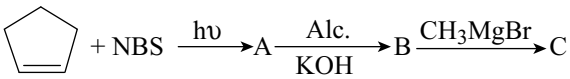
(a) 

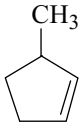
(b) 

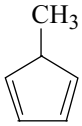
(c) 

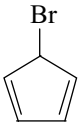
(d) 

6. The final product of the following reaction is



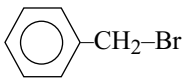
(a) 

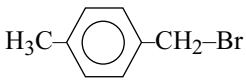
(b) 

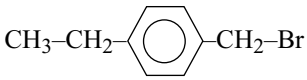
(c) 

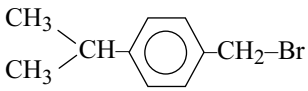
(d) None of these

7. Arrange the following compounds in order of decreasing rate of hydrolysis for $S_N1$reaction

(i) 

(ii) 

(iii) 

(iv) 

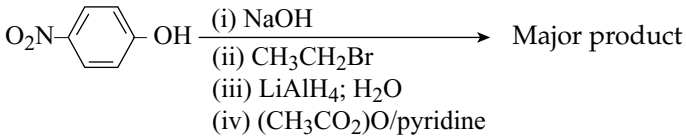
(a) iii > iv > ii > i

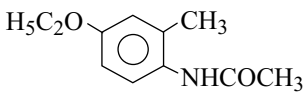
(b) iv > iii > ii > i

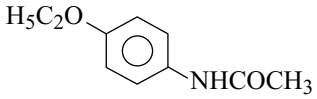
(c) ii > iii > iv > i

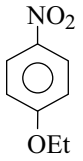
(d) i > ii > iii > iv

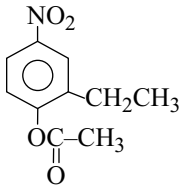
8. For the given reaction major product will be



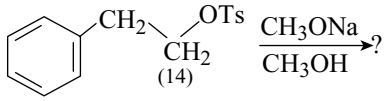
(a) 

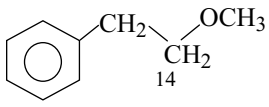
(b) 

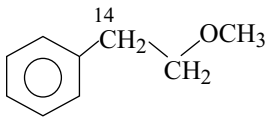
(c) 

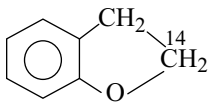
(d) 

9. The product/s formed is/are



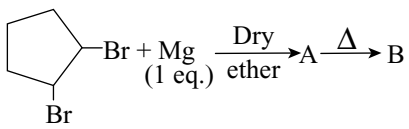
(a) 

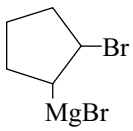
(b) 

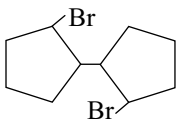
(c) 

(d) Both (a) and (b)

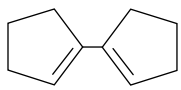
10. In the following reaction, compound (b) is

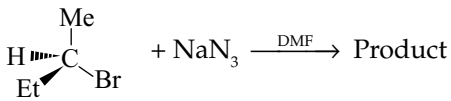


(a) 

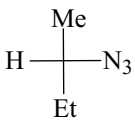
(b) 

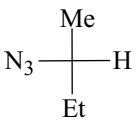
(c) 

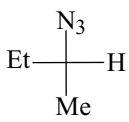
(d) 

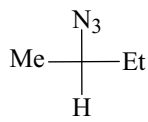
11. 

The correct representation of the product is

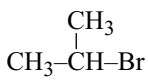
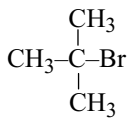
(a) 

(b) 

(c) 

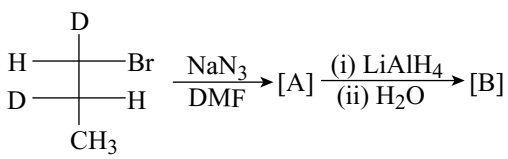
(d) 

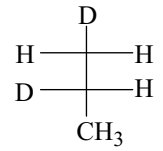
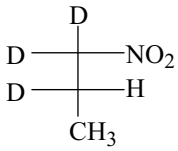
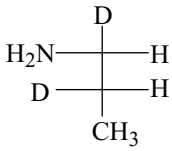
12. Arrange the following in the order of their reactivity with alcoholic AgCN to yield the substitution product

(i) $CH_3–CH_2Br$ (ii)  (iii) 

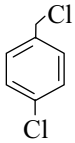
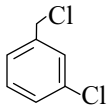
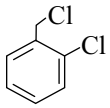
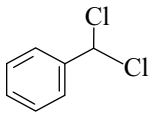
(a) i > ii > iii (b) (iii) > ii > i (c) ii > i > iii (d) i > iii > ii

13. The final product is

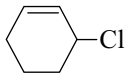
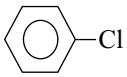
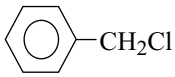


(a)  (b)  (c)  (d) None of these

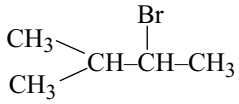
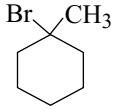
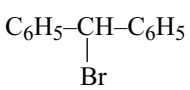
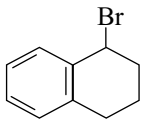
14. An aromatic compound (A), $C_7H_6Cl_2$, gives AgCl on boiling with alcoholic $AgNO_3$ solution and yields C_7H_7OCl on treatment with sodium hydroxide. (a) on oxidation gives a mono-chlorobenzoic acid which affords only one mononitroderivative. The compound (a) is

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

15. Which will give white ppt. with $AgNO_3 + NH_4OH$?

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

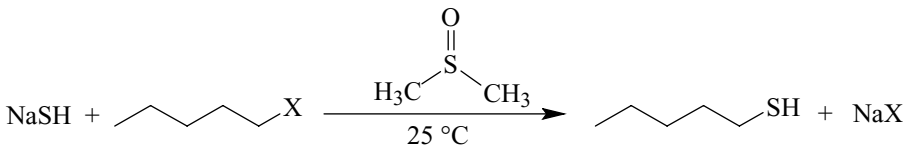
16. Consider the S_N1 solvolysis of the following halides in aqueous formic acid

(i)  (ii)  (iii)  (iv) 

Which one of the following is correct sequence of the halide given above in the decreasing order of their reactivity?

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

17. For which leaving group X would you predict the S_N2 reaction shown below to take place most rapidly?

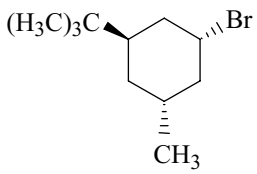
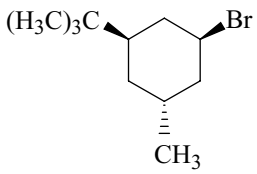


(a) X = –OH (b) X = –Cl (c) X = –Br (d) X = –I

18. Which of the following order is **correct** for dipole moment?

(a) $CH_3F > CH_3Cl > CH_3Br > CH_3I$ (b) $CH_3Cl > CH_3Br > CH_3F > CH_3I$
(c) $CH_3Br > CH_3Cl > CH_3I > CH_3F$ (d) $CH_3Cl > CH_3F > CH_3Br > CH_3I$

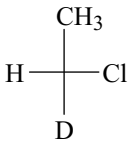
19. Choose the correct statement(s) concerning reactions of the two stereoisomers of 3-tert-butyl-5-methylbromocyclohexane.

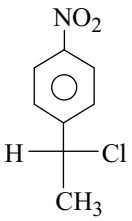
(i)  (ii) 

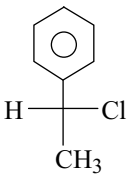
(i) 1 will undergo S_N1 reactions faster than 2
(ii) 1 will undergo E1 reactions faster than 2
(iii) 1 and 2 undergo S_N1 reactions at some rate

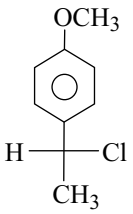
(a) i (b) ii (c) iii (d) i & ii

20. Under identical conditions, solvolysis of which of the following substrates would lead to maximum racemization?

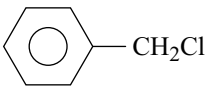
(a) 

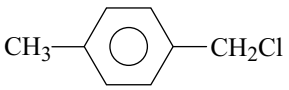
(b) 

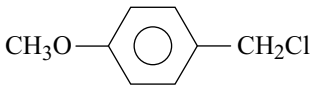
(c) 

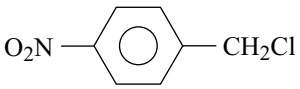
(d) 

21. Consider the following chlorides

(i) 

(ii) 

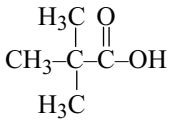
(iii) 

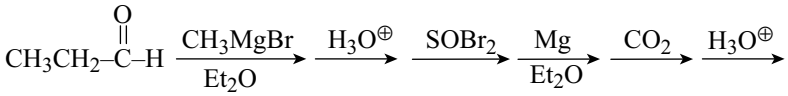
(iv) 

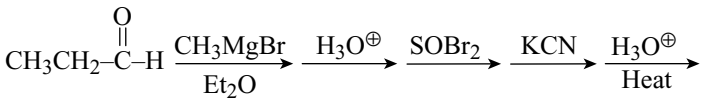
The order of reactivity of (i), (ii), (iii) and (iv) towards hydrolysis by S_N1 mechanism is

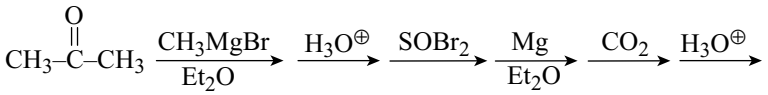
(a) i < ii < iii < iv (b) iv < iii < ii < i
(c) iv < i < ii < iii (d) iii < ii < i < iv

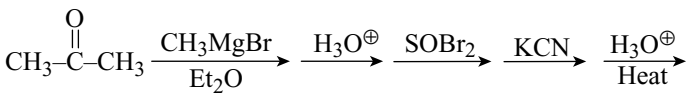
22. Which of the following would be the best synthesis of the acid shown below?



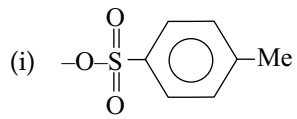
(a) 

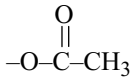
(b) 

(c) 

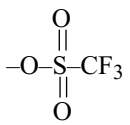
(d) 

23. Rank the groups in order of decreasing leaving group ability

(i) 

(ii) 

(iii) –OMe

(iv) 

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

24. In the given reaction

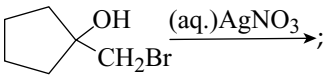
$C_6H_5–O–CH_2–CH_3 \xrightarrow{HI/\Delta}$ [X] + [Y]

[X] and [Y] will respectively be

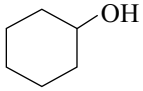
(a) C_6H_5I and $CH_3–CH_2–I$
(b) $C_6H_5–OH$ and $CH_3–CH_2–I$
(c) C_6H_5I and $CH_3–CH_2OH$
(d) C_6H_5OH and $CH_2=CH_2$

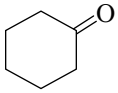
25. 1-Propanol can be prepared from propene by

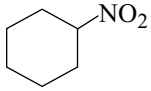
(a) $HOH/H^{\oplus}$
(b) $Hg(OAc)_2/H_2O$ and $NaBH_4$
(c) B_2H_6–THF and H_2O_2/OH^-
(d) All of these

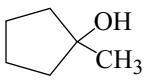
26. 

; Major product will be

(a) 

(b) 

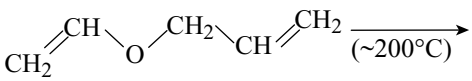
(c) 

(d) 

27. The decreasing order of reactivity of methyl alcohol (i), isopropyl alcohol (ii), tertiary butyl alcohol (iii) and ethyl alcohol (iv) for esterification will be

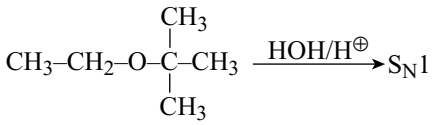
(a) i > ii > iii > iv
(b) iv > iii > ii > i
(c) i > iv > ii > iii
(d) i > iv > iii > ii

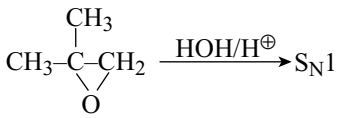
28. The product of the reaction is

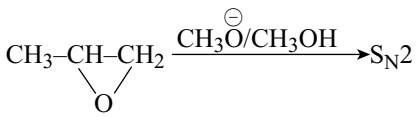


(a) $CH_2=CH–CH_2OH$
(b) CH_3CHO
(c) $CH_2=CH–CH_2–CH_2CHO$
(d) $CH_3–CH=CH–CH_2CHO$

29. Which of the following is correctly matched?

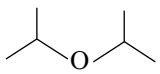
(a) 

(b) 

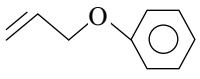
(c) 

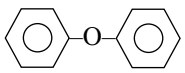
(d) All of these

30. Which of the following ether does not give peroxide formation?

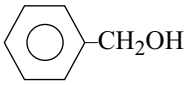
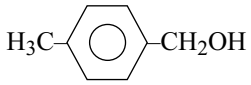
(a) 

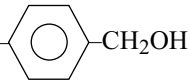
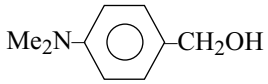
(b) 

(c) 

(d) 

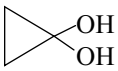
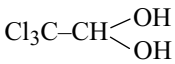
31. Correct order of the reactivity of the given alcohols towards the substitution with (NaBr + H_2SO_4)

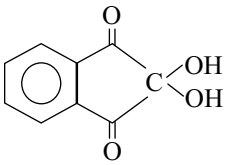
(i)  (ii) 

(iii)  (iv) 

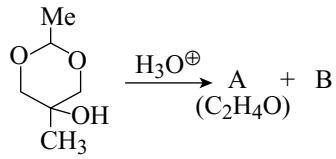
(a) i > ii > iii > iv (b) iv > ii > i > iii
(c) iii > i > ii > iv (d) iv > iii > ii > i

32. Which of the following is a stable hydrate?

(a)  (b) 

(c)  (d) all of these

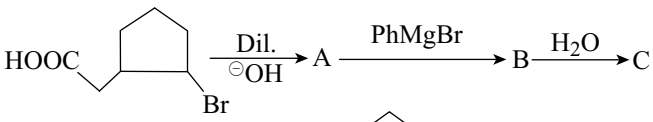
33. The products of the given reactions

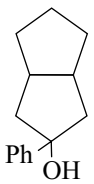
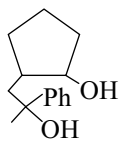
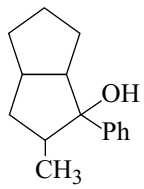


(B) $\xrightarrow{HIO_4}$ products

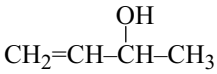
(a) CH_3CH_2COOH (b) HCHO (c) HCOOH (d) Both (a) and (b)

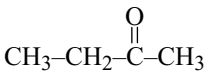
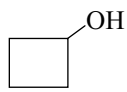
34. For the following reactions, the product C is



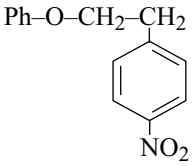
(a)  (b)  (c)  (d) none of these

35. Compound [X], whose MF is C_4H_8O gives positive haloform test but gives no 2, 4-DNP derivative is

(a)  (b) $CH_3–CH_2–CH_2–CHO$

(c)  (d) 

36. When HI is added in excess to the unsymmetrical ether



it results in

(a) $PhCH_2OH$ (b) PhI

(c) $HOCH_2CH_2Ph\text{-}NO_2$ (d) $ICH_2CH_2PhNO_2$

37. $CH_3–\underset{\underset{OH}{|}}{CH}–\underset{\underset{NH_2}{|}}{CH}–COOR \xrightarrow[(ii)\ H_3O]{(i)\ 1mol\ HIO_4}$ Products

The product mixture will contain

(a) $CH_3CHO + OHC–NH_2 + CO_2$ (b) CH_3COOH only

(c) $CH_3CHO + OHC–COOR + NH_3$ (d) $CH_3COOH + NH_2COOR + HCOOH$

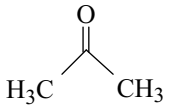
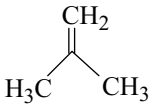
38. Williamson's synthesis is applied to prepare ether. Identify the ether from the following which cannot be prepared by it?

(a) $(CH_3)_3C–O–CH_2CH_2CH_3$ (b) $PhOCH_3$

(c) $CH_2=CH–CH_2–O–CH_3$ (d) $CH_3–CH=CH–O–CH=CH_2$

39. Which of the following predictions regarding the solubility of each pair of compounds in water are correct?

(i) CH_2Cl_2 is more soluble than CH_3OH in water

(ii)  is more soluble than  in water

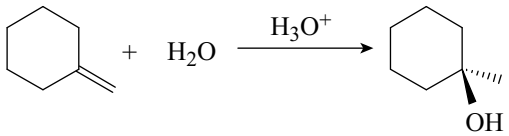
(iii) CH_3CH_2Cl is more soluble than NaCl in water

(iv) $CH_3CH_2CH_2SH$ is more soluble than $CH_3CH_2CH_2OH$ in water

(v)  is less soluble than  in water

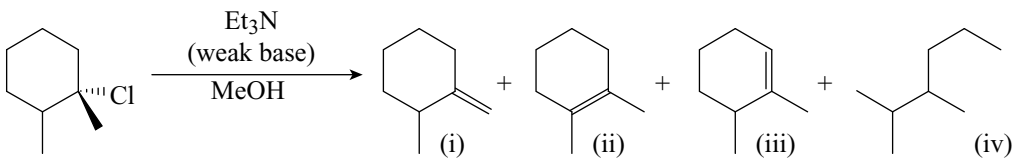
(a) iii, iv, v (b) i, ii, iv (c) ii, iv, v (d) ii, v

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



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

41. Arrange the yields (high to low) for the products of the following reaction and judge the possible mechanism.



(a) ii > iii > i > iv via E_1 mechanism
(b) ii > iv > iii > i via E_2 mechanism
(c) ii > iii > iv > i via E_1 mechanism
(d) iv > i > ii > iii via E_2 mechanism

42. What reagent can be used to convert 1-isopropylcyclopentene to 1-isopropyl-cyclopentanol?

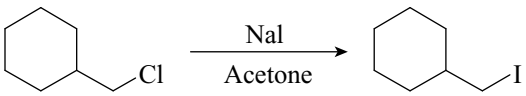
(a) HBr (b) H_2O, diluted H_2SO_4
(c) H_2/Pd (d) H_2O, neutral

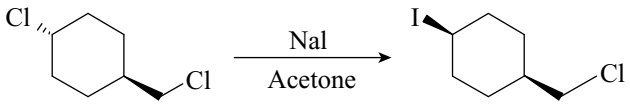
43. Which statements are true for S_N2 reaction of alkyl halides?

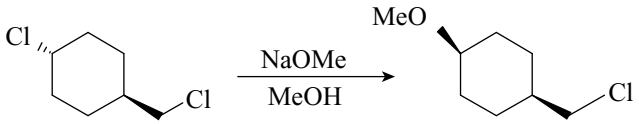
(i) Both of the alkyl halide and nucleophile are involved in the transition state.
(ii) Reaction proceeds with inversion of configuration at the substitution centre.
(iii) Reaction proceeds with retention of configuration at the substitution centre.
(iv) The order of reactivity is 3° > 2° > 1°.
(v) The nucleophile must have an unshared electron pair and bear a negative charge.
(vi) The greater the nucleophilicity of the nucleophile, the greater the rate of reaction.

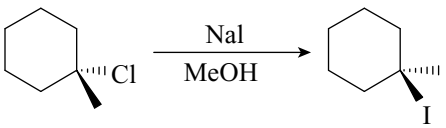
(a) i, ii, v, vi (b) i, iii, v, vi
(c) i, ii, iv, v (d) i, ii, vi

44. What reactions will likely occur through S_N1 mechanism?

(i) 

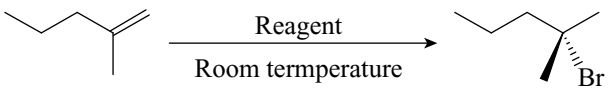
(ii) 

(iii) 

(iv) 

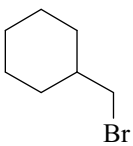
(a) ii, iii, iv (b) i, iv (c) iii, iv (d) ii, iii

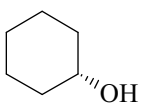
45. What is the reagent(s) needed for the following reaction?

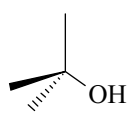


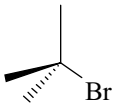
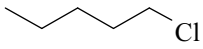
(a) HCl (b) NaBr (c) HBr (d) Br_2

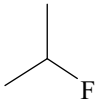
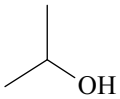
46. Which are secondary alkyl halides?

(i) 

(ii) 

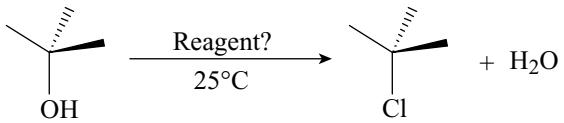
(iii) 

(iv)  (v)  (vi) 

(vii)  (viii)  (ix) CH_3OH (x) CH_3I

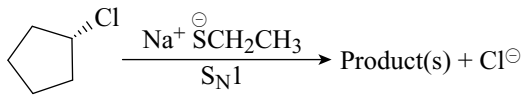
(a) i, vii (b) vii (c) v, x (d) i, v, vi, x

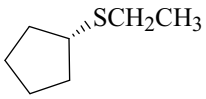
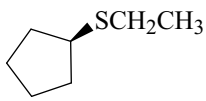
47. What reagent can be used for the following transformation?

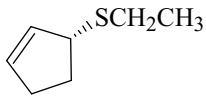


(a) HCl (b) $Na_2Cr_2O_7$ (c) Cl_2 (d) NaCl

48. What could be the product(s) for the following S_N1 reaction?

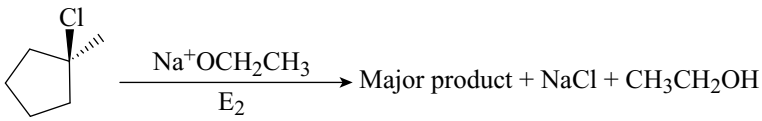


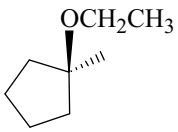
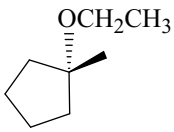
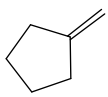
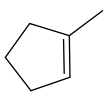
(i)  (ii) 

(iii)  (iv) 

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

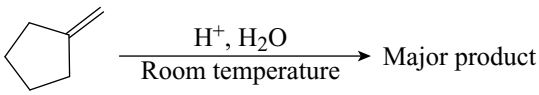
49. What could be the major product for the following E_2 reaction?

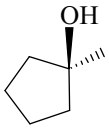
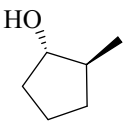
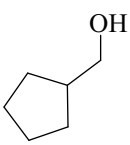
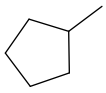


(i)  (ii)  (iii)  (iv) 

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

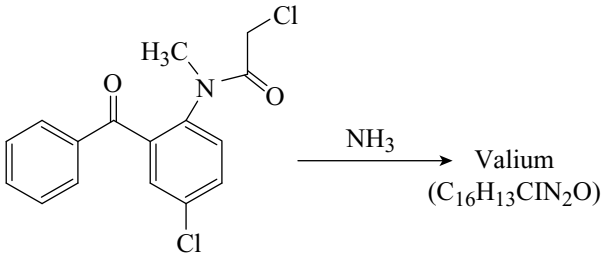
50. What could be the major product for the following reaction?



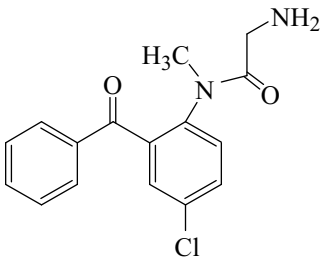
(i)  (ii)  (iii)  (iv) 

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

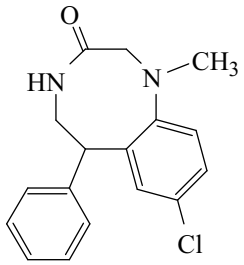
51. The last step in the synthesis of Valium® is treatment of the following aromatic compound with NH_3. Choose the correct structure of Valium®.



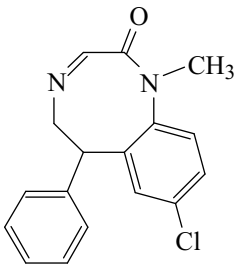
(a)



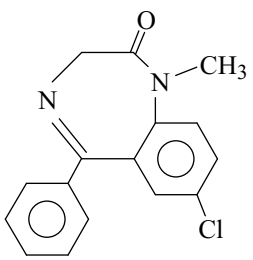
(b)



(c)

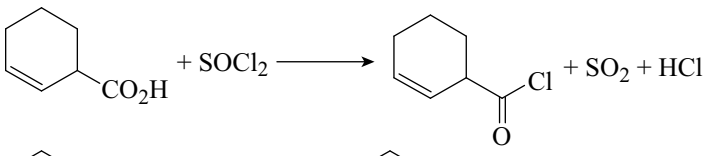


(d)

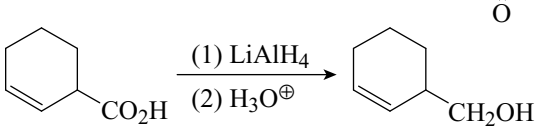


52. Choose the reaction that is not correctly shown.

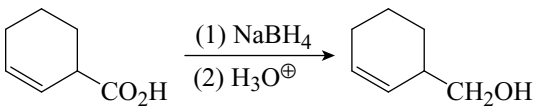
(a)



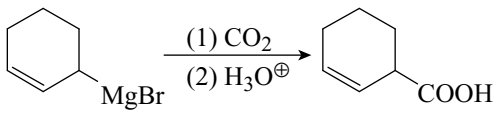
(b)



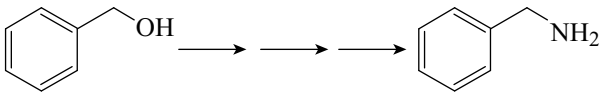
(c)

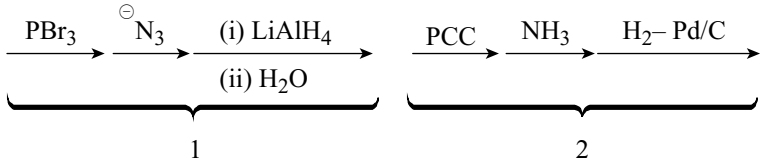


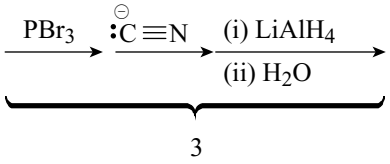
(d)



53. Choose those reactions that would give the following amine.

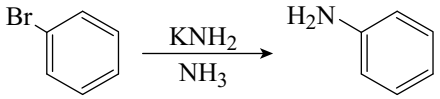


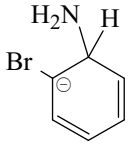


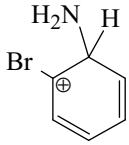


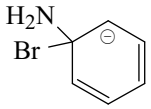
(a) 1 + 2 + 3 (b) 1 + 2 (c) 2 + 3 (d) 1 + 3

54. Bromobenzene reacts with potassium amide to form aniline. Identify the most important intermediate.



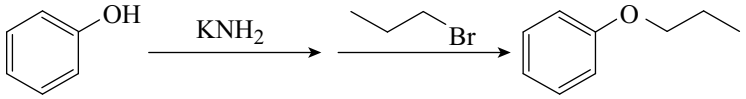
(a) 

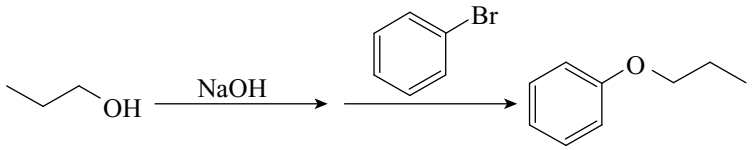
(b) 

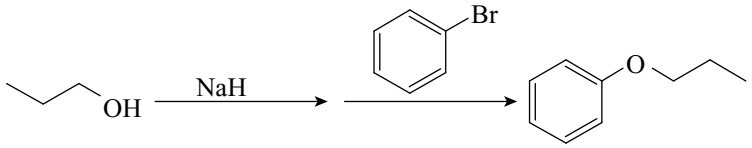
(c) 

(d) 

55. Here are three possible syntheses of phenylpropylether. Which one would work?

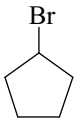
(i) 

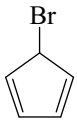
(ii) 

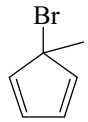
(iii) 

(a) i only (b) iii only (c) ii or iii (d) i or iii

56. Identify correct reactivity order for S_N1 reaction

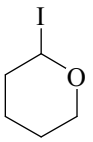
(i) 

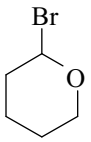
(ii) 

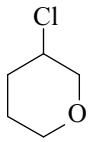
(iii) 

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

57. Identify correct reactivity order for S_N1 reaction

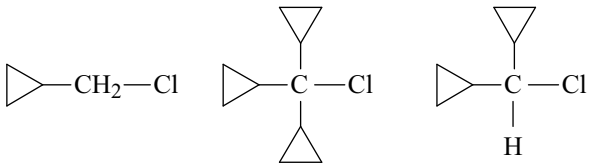
(i) 

(ii) 

(iii) 

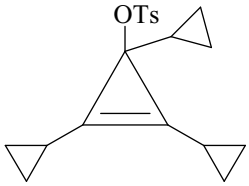
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

58. Identify correct reactivity order for S_N1 reaction.



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

59. Identify correct reactivity order for S_N1 reaction

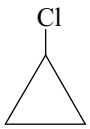
(i) 

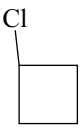
(ii) 

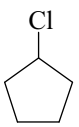
(iii) 

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

60. Identify correct reactivity order for S_N1 reaction

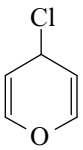
(i) 

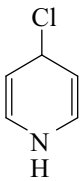
(ii) 

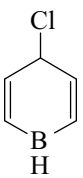
(iii) 

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

61. Identify correct reactivity order for S_N1 reaction

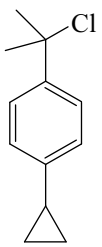
(i) 

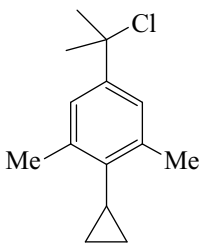
(ii) 

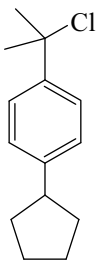
(iii) 

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

62. Identify correct reactivity order for S_N1 reaction

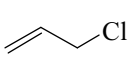
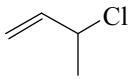
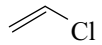
(i) 

(ii) 

(iii) 

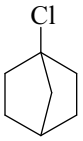
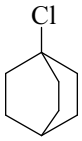
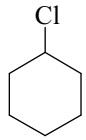
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

63. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

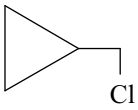
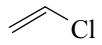
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) ii > i > iii

64. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

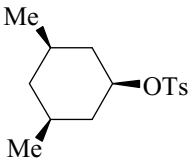
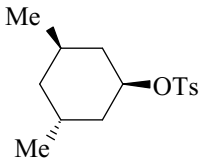
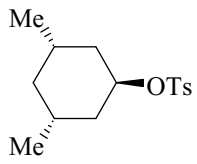
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

65. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

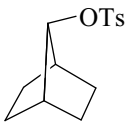
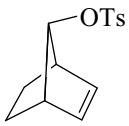
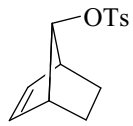
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

66. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

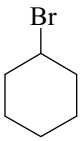
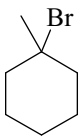
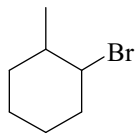
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

67. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

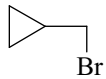
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

68. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

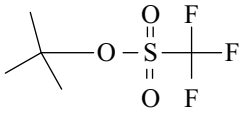
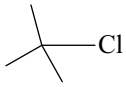
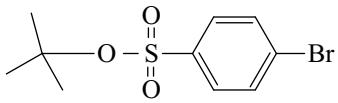
(a) i > ii > iii (b) ii > i > iii (c) i > iii > ii (d) iii > i > ii

69. Identify correct reactivity order for S_N1 reaction

(i) Ph—CH_2—Br (ii) Ph—Br (iii) 

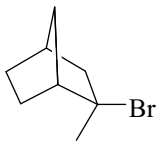
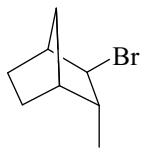
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

70. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

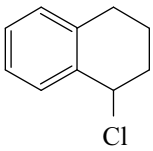
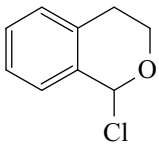
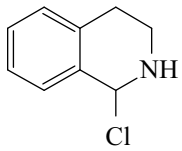
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

71. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

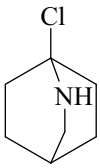
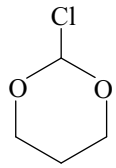
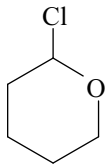
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

72. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

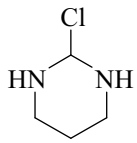
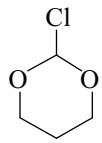
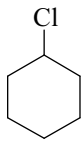
(a) i > ii > iii (b) iii > ii > i (c) i > iii > ii (d) iii > i > ii

73. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

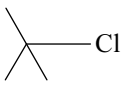
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

74. Identify correct reactivity order for S_N1 reaction

(i)  (ii)  (iii) 

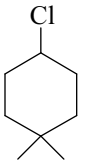
(a) i > ii > iii (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

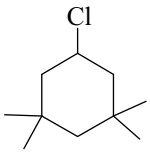
75. Identify correct reactivity order for S_N2 reaction

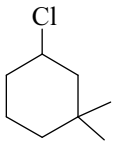
(i)  (ii)  (iii) 

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

76. Identify correct reactivity order for S_N2 reaction

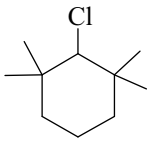
(i) 

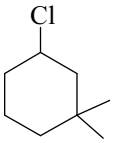
(ii) 

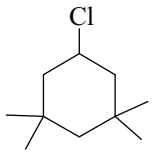
(iii) 

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

77. Identify correct reactivity order for S_N2 reaction

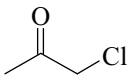
(i) 

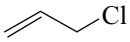
(ii) 

(iii) 

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

78. Identify correct reactivity order for S_N2 reaction

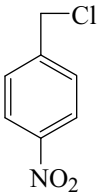
(i) 

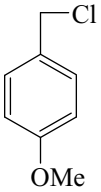
(ii) 

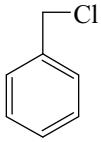
iii $H_3C—CH_2—Cl$

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

79. Identify correct reactivity order for S_N2 reaction

(i) 

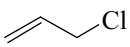
(ii) 

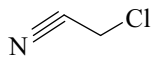
(iii) 

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

80. Identify correct reactivity order for S_N2 reaction

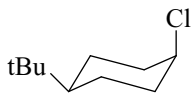
(i) 

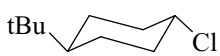
(ii) 

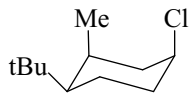
(iii) 

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

81. Identify correct reactivity order for S_N2 reaction

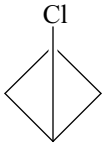
(i) 

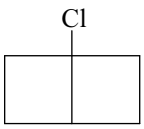
(ii) 

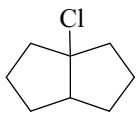
(iii) 

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

82. Identify correct reactivity order for S_N2 reaction

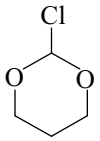
(i) 

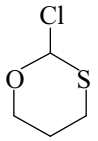
(ii) 

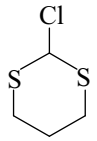
(iii) 

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

83. Identify correct reactivity order for S_N2 reaction

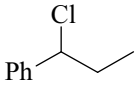
(i) 

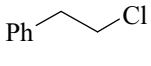
(ii) 

(iii) 

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

84. Identify correct reactivity order for E_2 reaction with alcoholic KOH

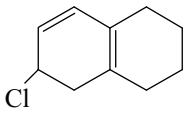
(i) 

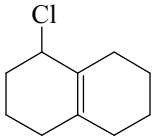
(ii) 

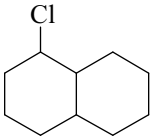
(iii) 

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

85. Identify correct reactivity order for E_2 reaction with alcoholic KOH

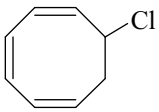
(i) 

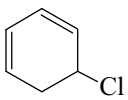
(ii) 

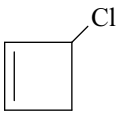
(iii) 

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

86. Identify correct reactivity order for E_2 reaction with alcoholic KOH

(i) 

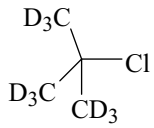
(ii) 

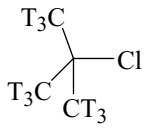
(iii) 

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

87. Identify correct reactivity order for E_2 reaction with alcoholic KOH

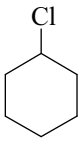
(i) 

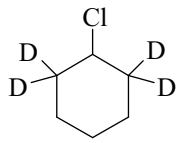
(ii) 

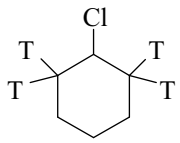
(iii) 

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

88. Identify correct reactivity order for E_2 reaction with alcoholic KOH

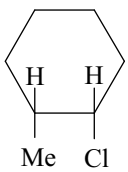
(i) 

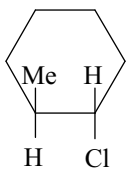
(ii) 

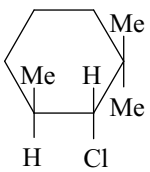
(iii) 

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

89. Identify correct reactivity order for E_2 reaction with alcoholic KOH

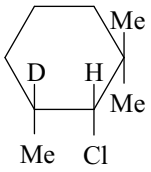
(i) 

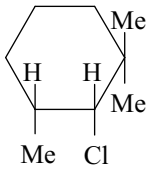
(ii) 

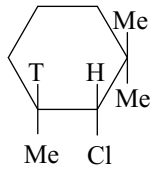
(iii) 

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

90. Identify correct reactivity order for E_2 reaction with alcoholic KOH

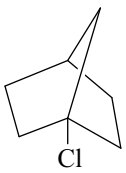
(i) 

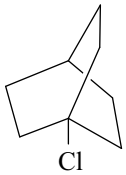
(ii) 

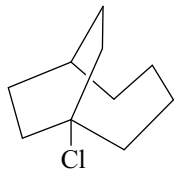
(iii) 

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

91. Identify correct reactivity order for E_2 reaction with alcoholic KOH

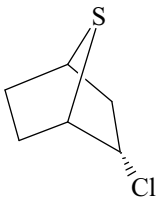
(i) 

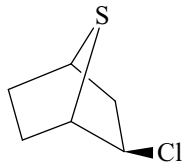
(ii) 

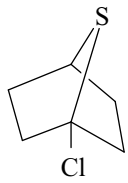
(iii) 

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

92. Identify rate of sololysis or hydrolysis

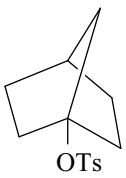
(i) 

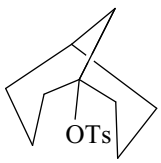
(ii) 

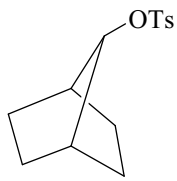
(iii) 

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

93. Identify rate of sololysis or hydrolysis

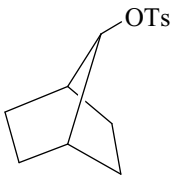
(i) 

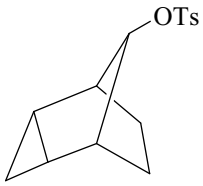
(ii) 

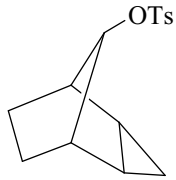
(iii) 

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

94. Identify rate of sololysis or hydrolysis

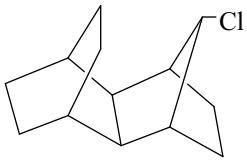
(i) 

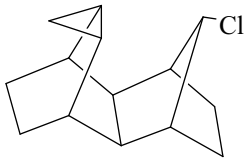
(ii) 

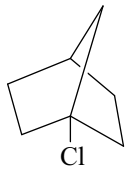
(iii) 

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

95. Identify rate of sololysis or hydrolysis

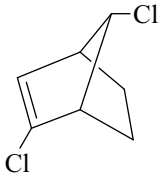
(i) 

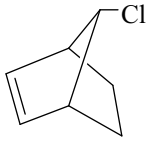
(ii) 

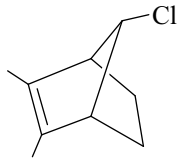
(iii) 

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

96. Identify rate of sololysis or hydrolysis

(i) 

(ii) 

(iii) 

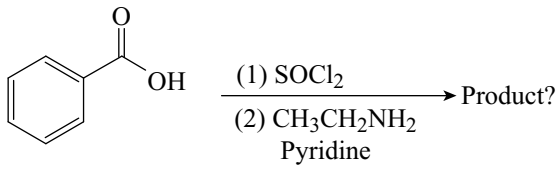
(a) iii > ii > i (b) ii > iii > i (c) i > iii > ii (d) iii > i > ii

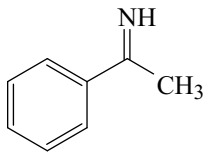
97. Which statements are true for S_N1 reaction of alkyl halides?

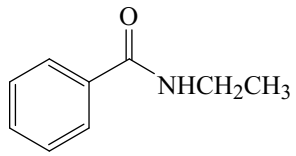
(i) Both of the alkyl halide and nucleophile are involved in the transition state.
(ii) Reaction proceeds with inversion of configuration at the substitution centre.
(iii) Reaction proceeds via the formation of carbocation intermediate.
(iv) The order of reactivity is 3° > 2° > 1°.
(v) The nucleophile must have an unshared electron pair and bear a negative charge.
(vi) Protic solvents favour S_N1 reaction.

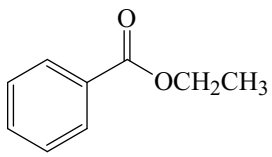
(a) iii, iv, vi (b) ii, iv, v (c) i, ii, vi (d) i, ii, v, vi

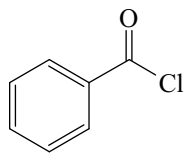
98. What could be the product for the following reaction?



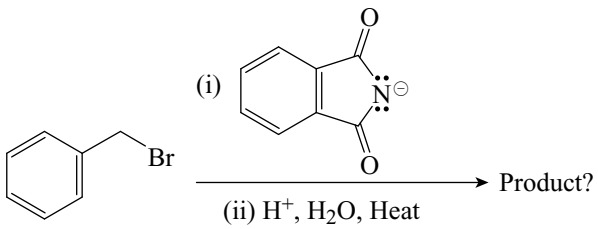
(a) 

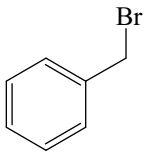
(b) 

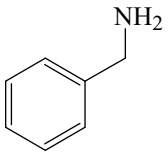
(c) 

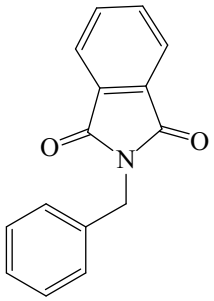
(d) 

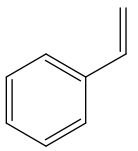
99. What could be the product for the following reaction?

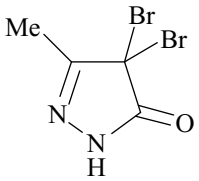


(a) 

(b) 

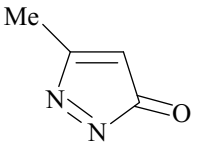
(c) 

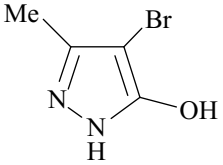
(d) 

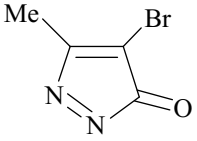
100. 

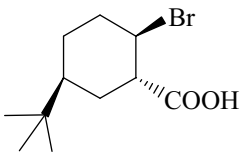
$\xrightarrow[\text{(ii) HCl, } H_2O]{\text{(i) NaOH, } H_2O}$ Major product is

(a) $Me - C \equiv C - COOH$

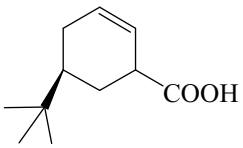
(b) 

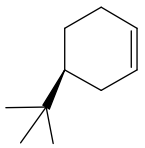
(c) 

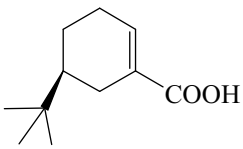
(d) 

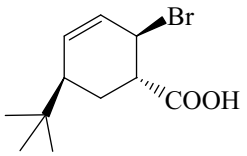
101. 

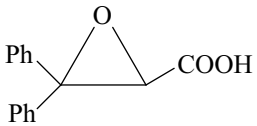
$\xrightarrow[\Delta]{\text{Base}}$ Major Product?

(a) 

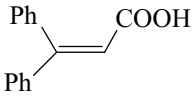
(b) 

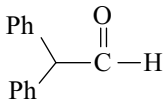
(c) 

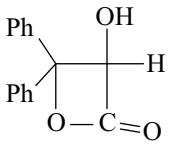
(d) 

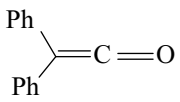
102. 

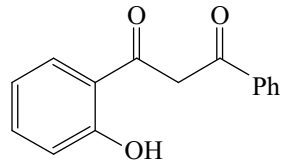
$\xrightarrow{\Delta}$ Major product

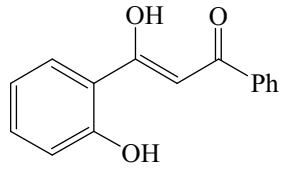
(a) 

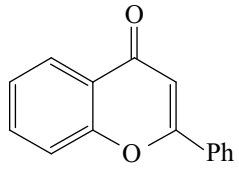
(b) 

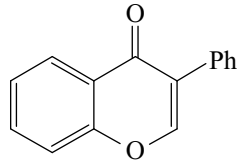
(c) 

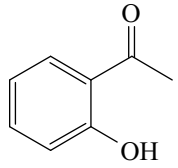
(d) 

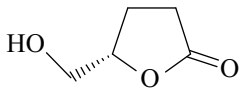
103.  $\xrightarrow{H^+}$ Major product

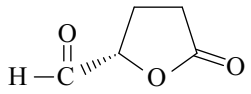
(a) 

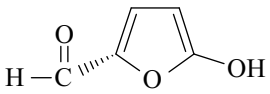
(b) 

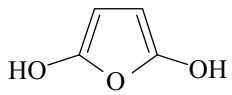
(c) 

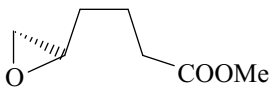
(d) 

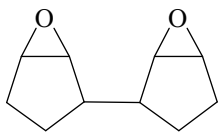
104.  $\xrightarrow[\text{(ii) } K_2CO_3, \text{MeOH}]{\text{(i) } T_SCl}$ Major product

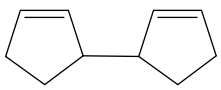
(a) 

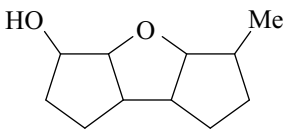
(b) 

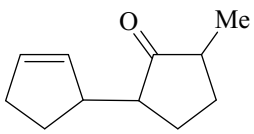
(c) 

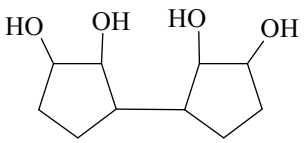
(d) 

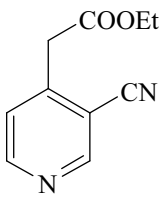
105.  $\xrightarrow[\text{(ii) } H_2O]{\text{(i) 1 eq. Me MgCl}}$ Major product

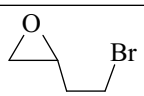
(a) 

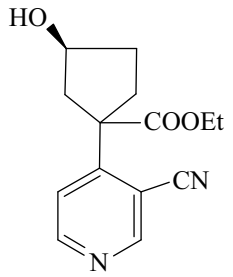
(b) 

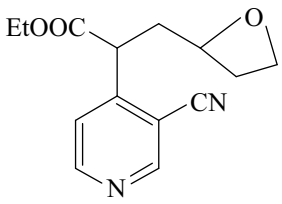
(c) 

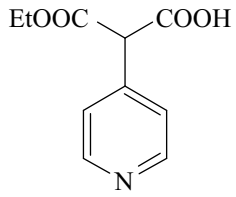
(d) 

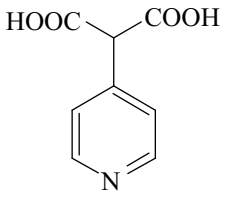
106.  $\xrightarrow[\text{(ii)}]{\text{(i) NaOEt}}$ Major product

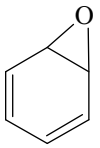


(a) 

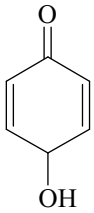
(b) 

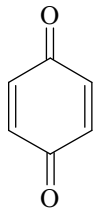
(c) 

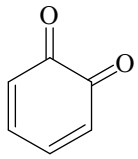
(d) 

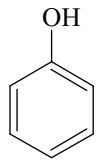
107. 

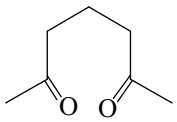
$\xrightarrow{\text{Conc. } H_2SO_4}$ Major product

(a) 

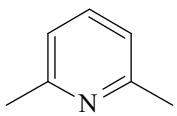
(b) 

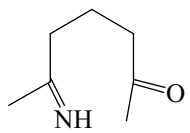
(c) 

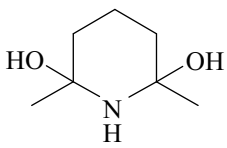
(d) 

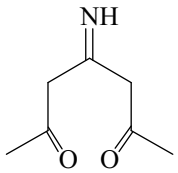
108. 

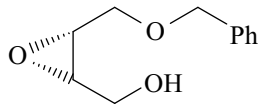
$+NH_2 — OH \xrightarrow[H^+]{\Delta}$ Major product

(a) 

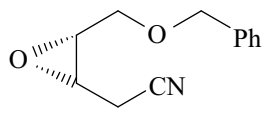
(b) 

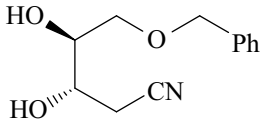
(c) 

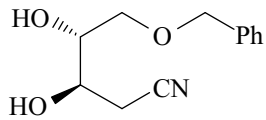
(d) 

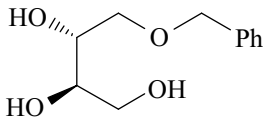
109. 

$\xrightarrow[\text{(ii) NaCN/DMSO}]{\text{(i) NaOH/H}_2\text{O}}$ Major product

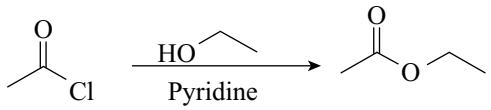
(a) 

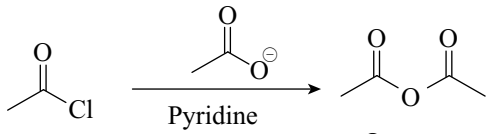
(b) 

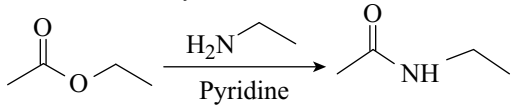
(c) 

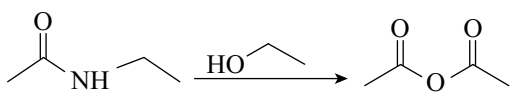
(d) 

110. Four of the five reactions shown below should proceed as shown to give good yields. One of reaction has problems and will not proceed as indicated. Identify this one reaction which will not proceed as shown.

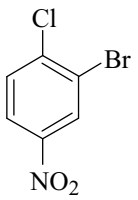
(a) 

(b) 

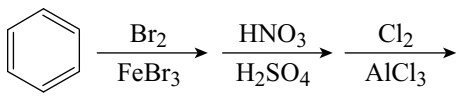
(c) 

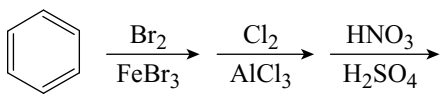
(d) 

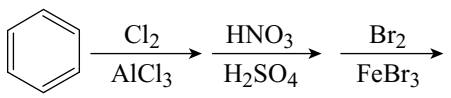
111. Which of the following synthetic schemes would be the best for the synthesis of the compound, 2-bromo-1-chloro-4-nitrobenzene?

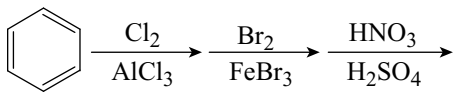


2-bromo-1-chloro-4-nitrobenzene

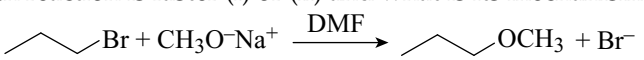
(a) 

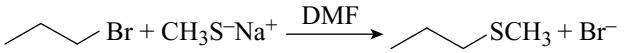
(b) 

(c) 

(d) 

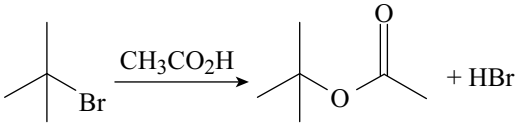
112. Which reaction is faster (i) or (ii) and what is its mechanism?

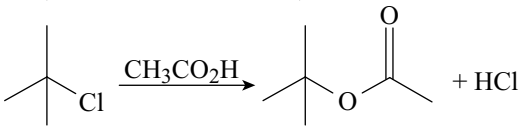
(i) 

(ii) 

(a) reaction i, S_N1
(b) reaction ii, S_N2
(c) reaction ii, S_N1
(d) reaction i, S_N2

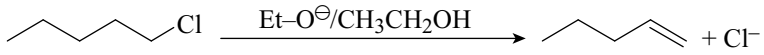
113. Which reaction is faster (i) or (ii) and what is its mechanism?

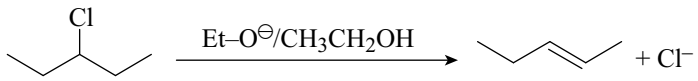
(i) 

(ii) 

(a) reaction ii, S_N1
(b) reaction ii, S_N2
(c) reaction i, S_N1
(d) reaction i, S_N2

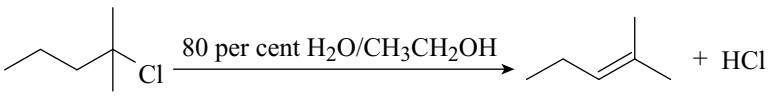
114. Which reaction is faster (i) or (ii) and what is its mechanism?

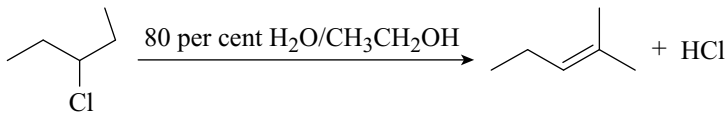
(i) 

(ii) 

(a) reaction ii, E2
(b) reaction i, E2
(c) reaction i, E1
(d) reaction ii, E1

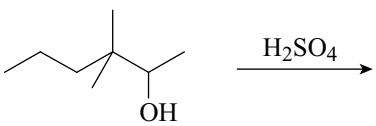
115. Which reaction is faster (i) or (ii) and what is its mechanism?

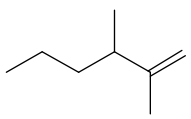
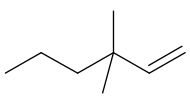
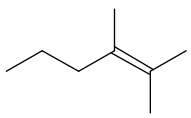
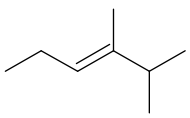
(i) 

(ii) 

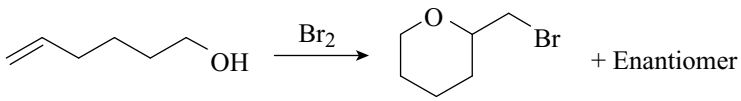
(a) reaction ii, E1
(b) reaction i, E2
(c) reaction ii, E2
(d) reaction i, E1

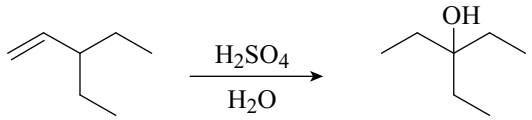
116. Predict the major product of the following reaction.

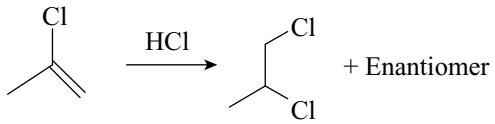


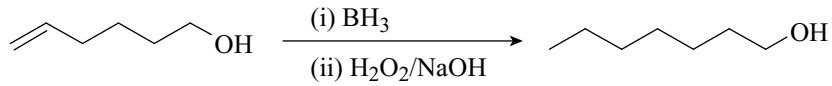
(a) 
(b) 
(c) 
(d) 

117. Which ONE of the following reactions is NOT correct?

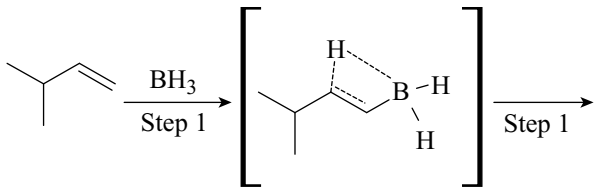
(a) 

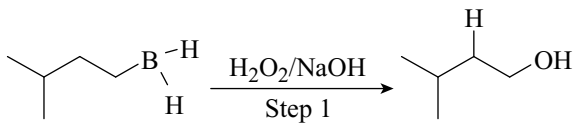
(b) 

(c) 

(d) 

118. Consider the following reaction.

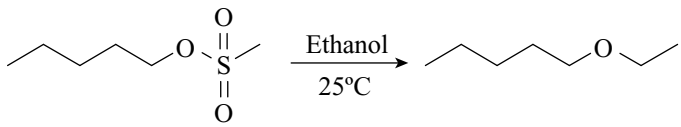


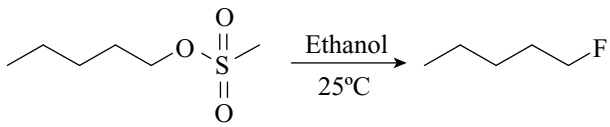


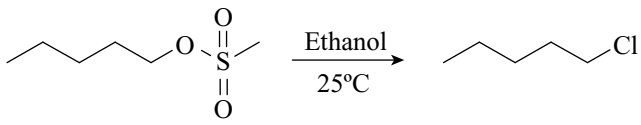
Which ONE of the following statements is INCORRECT?

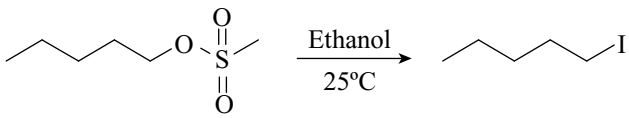
(a) In step 1, the boron atom acts as a Lewis base.
(b) In step 2, the boron atom is oxidized by hydrogen peroxide.
(c) The borane addition occurs with syn-stereospecificity.
(d) In step 1, a hydride is added at carbon 2.

119. Which one of the following five S_N2 reactions will take place most rapidly?

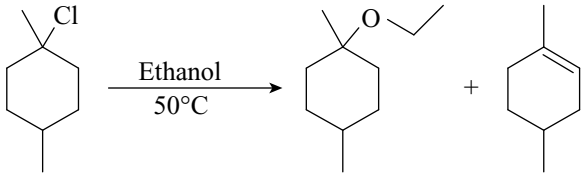
(a) $CH_3CH_2OH +$ 

(b) $F^{\ominus} +$ 

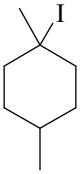
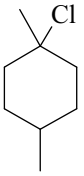
(c) $Cl^{\ominus} +$ 

(d) $I^{\ominus} +$ 

120. Which of the following changes will increase the rate of elimination reaction in the following reaction?

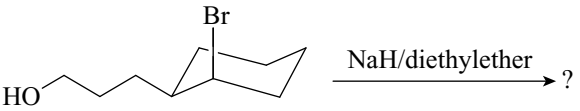


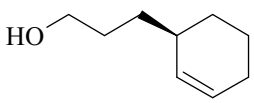
(i) using 100°C instead of 50°C (ii) using water instead of ethanol

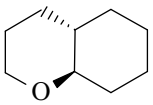
(iii) adding ethoxide to the ethanol (iv) using  instead of 

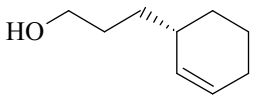
(a) i and ii (b) ii and iii (c) i, iii and iv (d) iii and iv

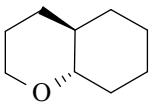
121. Which one of the following is the major product of the reaction below?



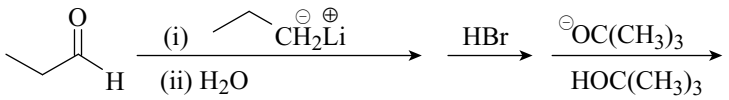
(a) 

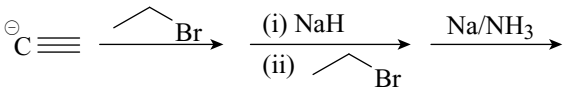
(b) 

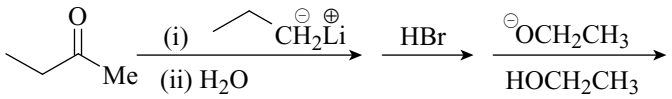
(c) 

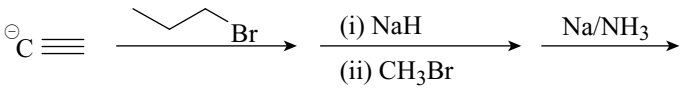
(d) 

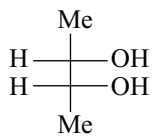
122. Which one of the sequences below is the best synthesis of (E)-3-hexene?

(a) 

(b) 

(c) 

(d) 

123. Which reactions will provide the following diol as the major product  ?

(i) $\xleftarrow[(2)\ NaHSO_3]{(1)\ OsO_4}$ 

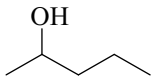
(ii) $\xleftarrow[(2)\ H_3O^+]{(1)\ RCO_3H}$ 

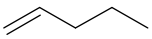
(iii) $\xleftarrow[(2)\ NaHSO_3]{(1)\ OsO_4}$ 

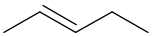
(iv) $\xleftarrow[(2)\ H_3O^+]{(1)\ RCO_3H}$ 

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

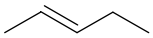
124. Which is the best synthesis of the following alcohol?



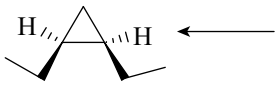
(a) $\xleftarrow[(2)\ BH_4^{\ominus}]{(1)\ Hg(OAc)_2}$ 

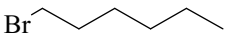
(b) $\xleftarrow[(2)\ BH_4^{\ominus}]{(1)\ Hg(OAc)_2}$ 

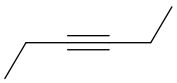
(c) $\xleftarrow[(2)\ H_2O_2/HO^{\ominus}]{(1)\ BH_3}$ 

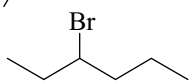
(d) $\xleftarrow[H_2O]{H^{\oplus}}$ 

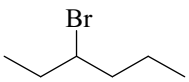
125. Which is the best synthesis of the following cyclopropane?



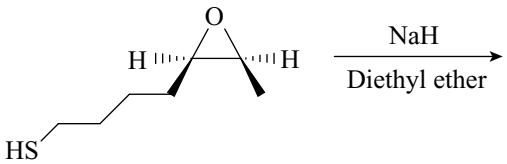
(a) $\xleftarrow{CH_2I_2}$ $\xleftarrow{{}^{\ominus}OH}$ 

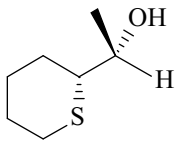
(b) $\xleftarrow[Zn/Cu]{CH_2I_2}$ $\xleftarrow{H_2/Linear}$ 

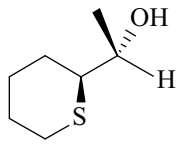
(c) $\xleftarrow[Zn/Cu]{CH_2I_2}$ $\xleftarrow{{}^{\ominus}OC(CH_3)_3}$ 

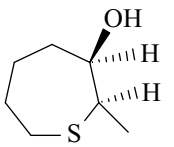
(d) $\xleftarrow[Zn/Cu]{CH_2I_2}$ $\xleftarrow{{}^{\ominus}OH}$ 

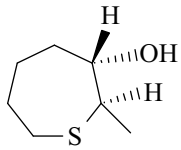
126. Which is the correct product of the following reaction?



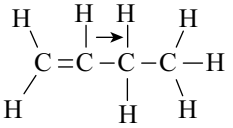
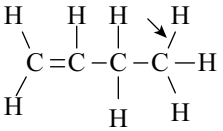
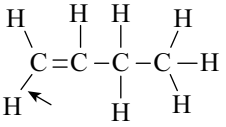
(a) 

(b) 

(c) 

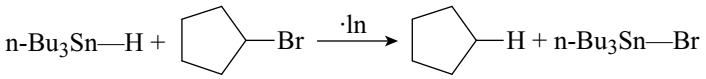
(d) 

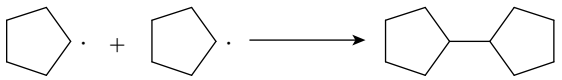
127. Arrange the indicated C—H bonds in order of increasing reactivity towards chlorination.

(i)  (ii)  (iii) 

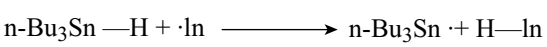
(a) (ii) < (i) < (iii) Increasing reactivity (b) (i) < (ii) < (iii) Increasing reactivity (c) (ii) < (iii) < (i) Increasing reactivity (d) (i) < (iii) < (ii) Increasing reactivity

128. Choose those reaction(s) that is (are) the propagation step(s) in the following free radical chain reaction.



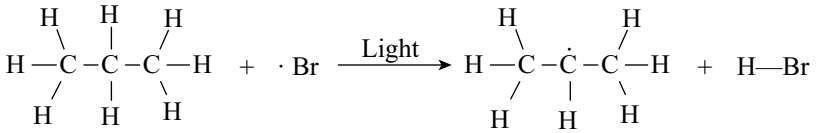
(i) 

(ii) 

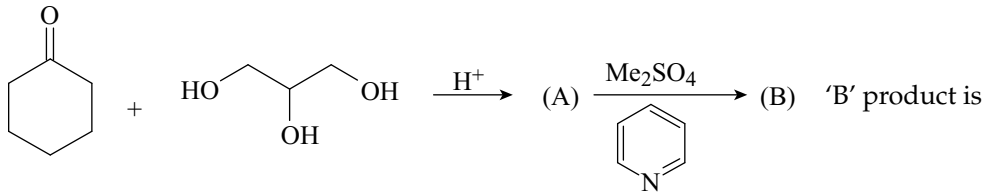
(iii) 

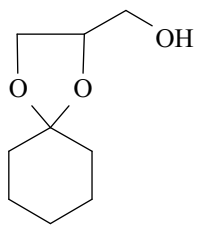
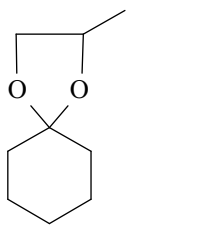
(a) i (b) ii (c) iii (d) i and ii

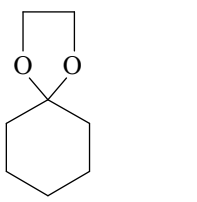
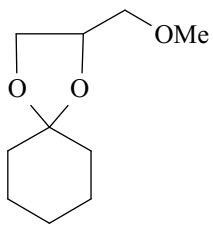
129. Choose the answer that is correct for the ΔH°(kJ/mole) of the following step in the bromination of propane.



(a) Exothermic (b) Endothermic (c) Reversible (d) Irreversible

130.  'B' product is

(a)  (b) 

(c)  (d) 

LEVEL 2

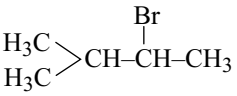
Single and Multiple-choice Type

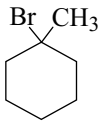
1. Which of the following shows greater reactivity towards S_N2 reaction than $CH_3—CH_2Br$ with sodium methoxide?

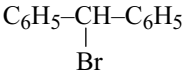
(a) $CH_3–O–CH_2Br$ (b) CH_3Br

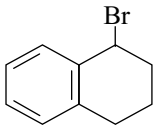
(c) $CH_2=CH–Br$ (d) $CH_2=CH–CH_2Br$

2. Consider the S_N1 solvolysis of the following halides in aqueous formic acid?

(i) 

(ii) 

(iii) 

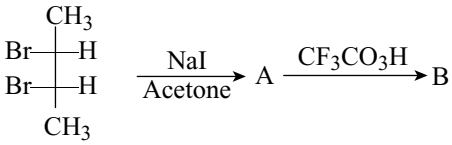
(iv) 

Which one of the following is correct sequence of the halides, given above, in the decreasing order of their reactivity?

(a) iii > iv > ii > i (b) ii > iv > i > iii

(c) i > ii > iii > iv (d) iii > i > ii > iv

3. The correct statement for the given reaction is



(a) B is optically inactive due to external compensation

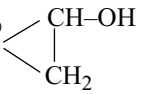
(b) B is optically inactive due to internal compensation

(c) A is predominantely cis-alkene

(d) B does not have chiral centres

4. $CH_3–CH_2SH \xrightarrow[\text{(ii) Ethylene oxide}]{\text{(i) Dil. } \overset{\ominus}{O}H} \xrightarrow[\text{(iii) } H_2O]{}$ Product, product is

(a) $CH_3–CH_2–S–CH_2–CH_2–OH$ (b) $CH_3–CH_2O^-$

(c) $CH_3–CH_2–O–CH_2–CH_2–OH$ (d) 

5. Which of the following statements are correct?

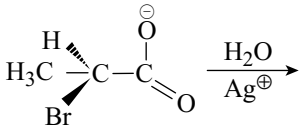
(a) The S_N1 reaction obeys the Ist order kinetics

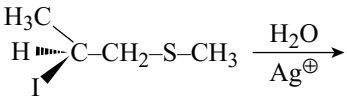
(b) The solvolysis of ethylbromide in ethanoic solution is first order kinetics

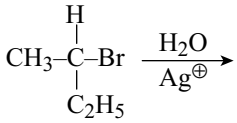
(c) R configuration of a compound may result in R and S configurations in an S_N2 reaction

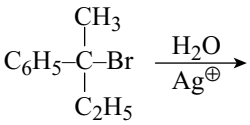
(d) 1-Bromo-1-phenylethane shows greater reactivity towards S_N1 and S_N2 reaction compared to isopropyl bromide

6. Which of the following reactions will proceed with retention of configuration only (no inversion) at the chiral carbon?

(a) 

(b) 

(c) 

(d) 

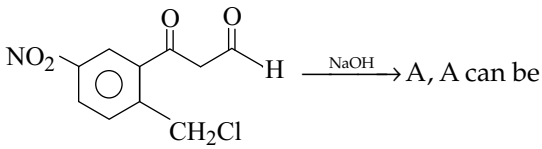
7. Correct statements is

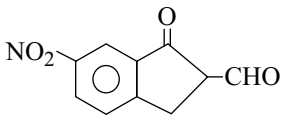
(a) Nucleophilicity of $\overset{\ominus}{S}H$ is greater than $\overset{\ominus}{O}H$ in dimethyl formamide

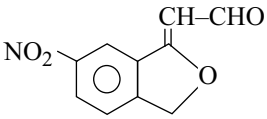
(b) Hydrazine is a better nucleophile than NH_3

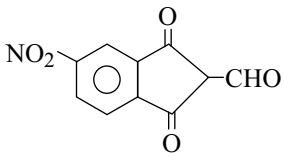
(c) Phenoxide ion is more basic than acetate ion

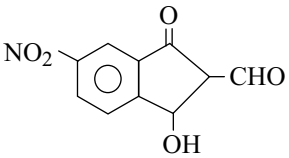
(d) $\overset{\ominus}{C}H_3$ is a better nucleophile than $\overset{\ominus}{O}H$ in a non-polar solvent

8.  A, A can be

(a) 

(b) 

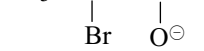
(c) 

(c) 

9. Identify the compounds that will undergo substitution reaction faster than C_2H_5Br with OH^-/DMSO.

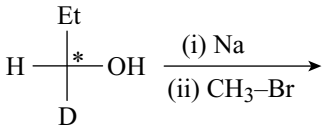
(a) CH_3CH_2–S–CH_2CH_2Br

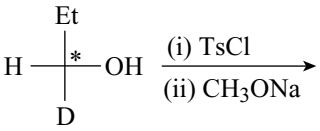
(b) CH_3–CH_2CH_2Br

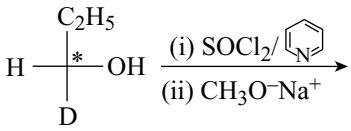
(c) 

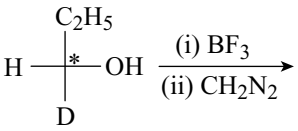
(d) CH_3–CH(Br)–CH_3

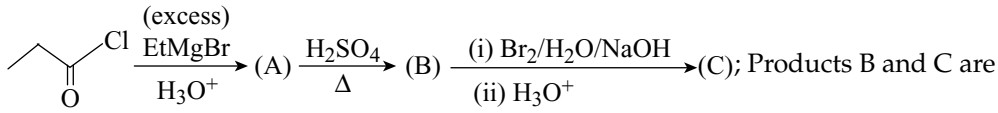
10. In which of the following cases, the configuration of chiral C is retained in product?

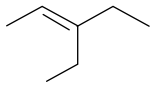
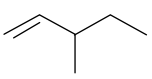
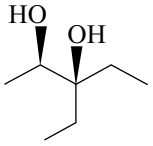
(a) 

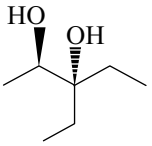
(b) 

(c) 

(d) 

11. 

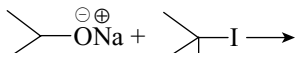
(a)  (b)  (c) 

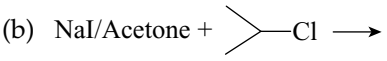
(d) 

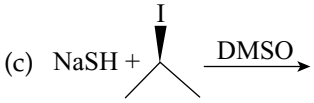
12. Which statement is/are correct in the following statements?

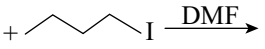
(a) Allyl bromide gives S_N1 reaction but vinyl chloride does not.
(b) Primary alkyl halides can give S_N1 or S_N2 reaction. This depends on the structure of the substrate and nature of solvent.
(c) $CH_3–CH=CH–CH_2Cl$ reacts with KCN to give mixture of two isomeric products.
(d) $CH_3–CH_2–O–CH_2Br$ is less reactive than tert. butyl bromide for S_N1 reaction.

13. Identify reaction that follows S_N2 path

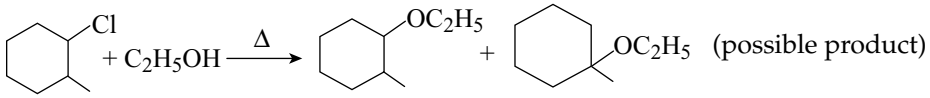
(a) 

(b) 

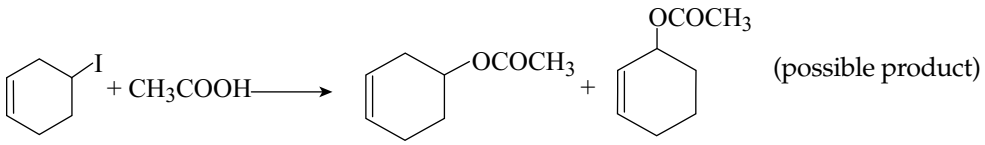
(c) 

(d) 

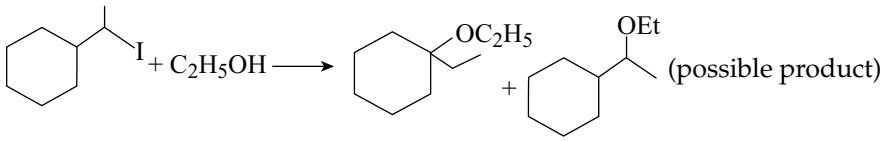
14. Which of the reactions give the correct product?

(a) 

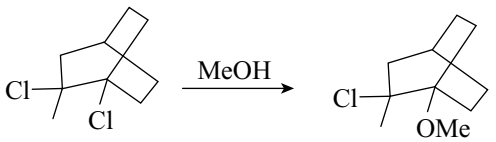
(possible product)

(b) 

(possible product)

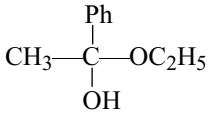
(c) 

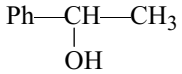
(possible product)

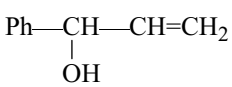
(d) 

(major product)

15. Which of the following alcohol gives the white turbidity immediately with HCl + $ZnCl_2$ (anhy.)?

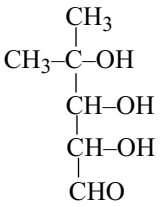
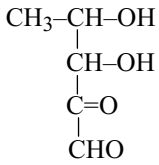
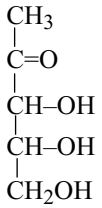
(a) 

(b) 

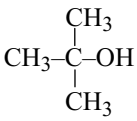
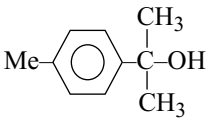
(c) 

(d) $CH_3–CH_2CH_2OH$

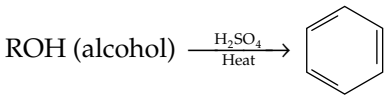
16. $A \xrightarrow{HIO_4} CH_3CHO + 2HCOOH + CH_3COOH$. The structure of A is

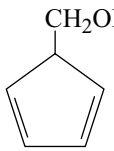
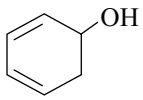
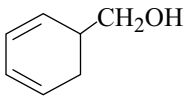
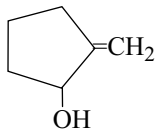
(a) 
(b) 
(c) 
(d) none of these

17. Which of the following gives turbidity immediately with Lucas-reagent (anhy. $ZnCl_2$ + HCl)?

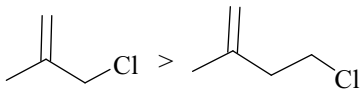
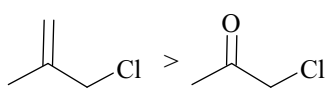
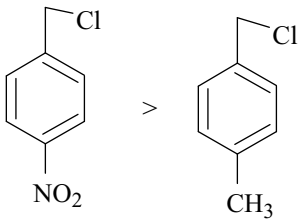
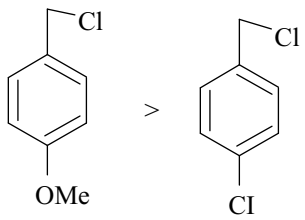
(a) 
(b) 
(c) 
(d) CH_3CH_2OH

18. The possible structure of the alcohol is

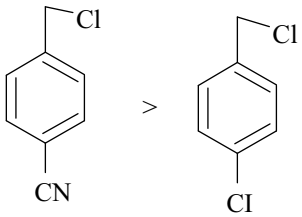
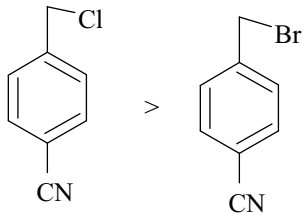
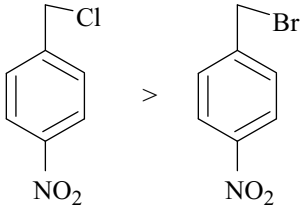
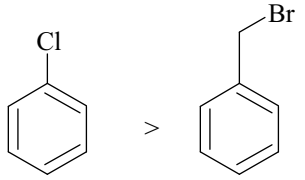


(a) 
(b) 
(c) 
(d) 

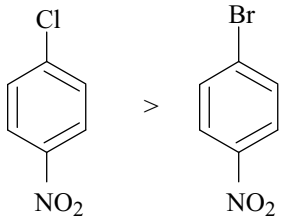
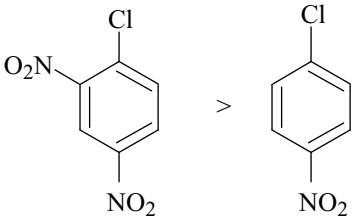
19. Identify correct reactivity order for S_N2 reaction

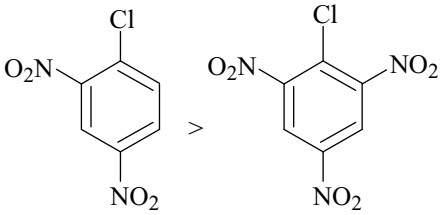
(a) 
(b) 
(c) 
(d) 

20. Identify correct reactivity order for S_N2 reaction

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

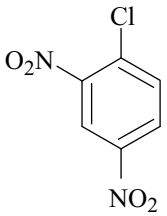
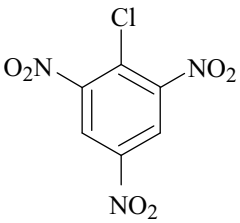
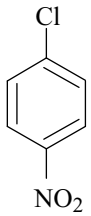
21. Identify correct reactivity order for ArSN reaction

(a)  (b) 

(c) 

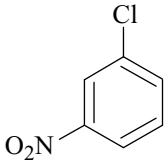
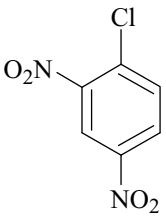
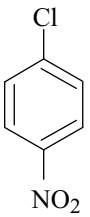
(d) (a) and (b) are correct

22. Identify correct reactivity order for ArSN reaction

(i)  (ii)  (iii) 

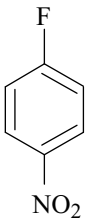
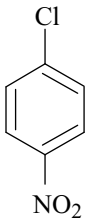
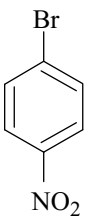
(a) i > ii > iii
(b) ii > i > iii
(c) i > iii > ii
(d) iii > i > ii

23. Identify correct reactivity order for ArSN reaction

(i)  (ii)  (iii) 

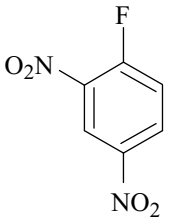
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > i > ii

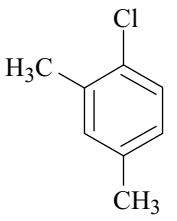
24. Identify correct reactivity order for ArSN reaction

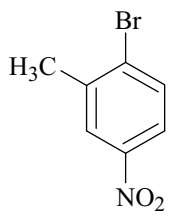
(i)  (ii)  (iii) 

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

25. Identify correct reactivity order for ArSN reaction

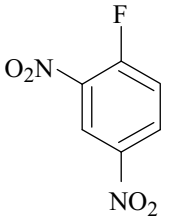
(i) 

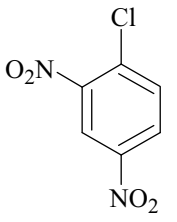
(ii) 

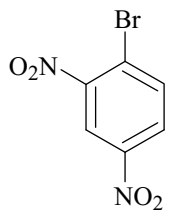
(iii) 

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

26. Identify correct reactivity order for ArSN reaction

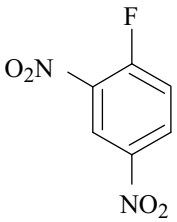
(i) 

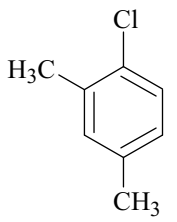
(ii) 

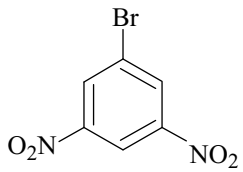
(iii) 

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

27. Identify correct reactivity order for ArSN reaction

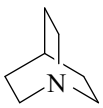
(i) 

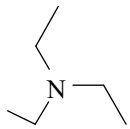
(ii) 

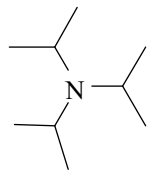
(iii) 

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

28. Identify correct nucleophilicity order

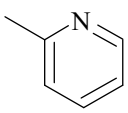
(i) 

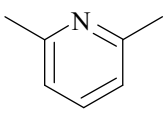
(ii) 

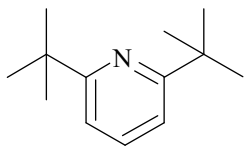
(iii) 

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

29. Identify correct nucleophilicity order

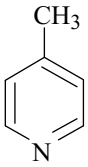
(i) 

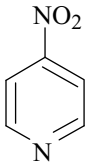
(ii) 

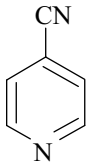
(iii) 

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

30. Identify correct nucleophilicity order

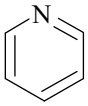
(i) 

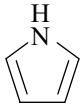
(ii) 

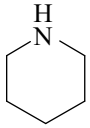
(iii) 

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

31. Identify correct nucleophilicity order

(i) 

(ii) 

(iii) 

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

32. Identify correct nucleophilicity order

(i) H_2O (ii) H_2S (iii) H_2Se

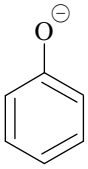
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > ii > i

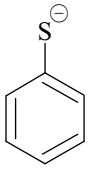
33. Identify correct nucleophilicity order

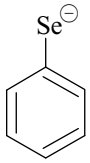
(i) PH_3 (ii) NH_3 (iii) AsH_3

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

34. Identify correct nucleophilicity order

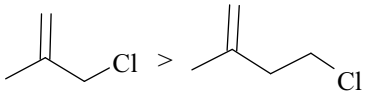
(i) 

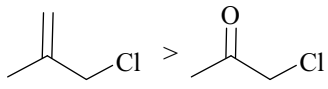
(ii) 

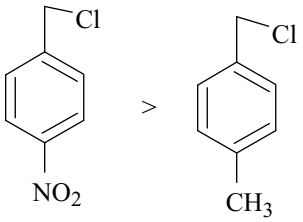
(iii) 

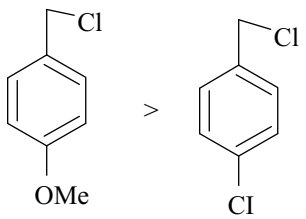
(a) i > ii > iii
(b) ii > iii > i
(c) i > iii > ii
(d) iii > ii > i

35. Identify correct reactivity order for S_N1 reaction

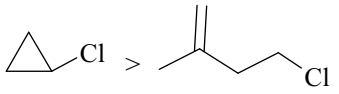
(a) 

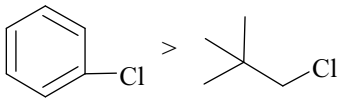
(b) 

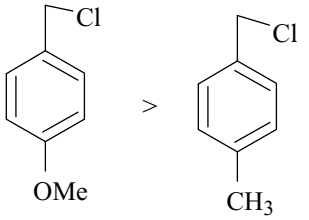
(c) 

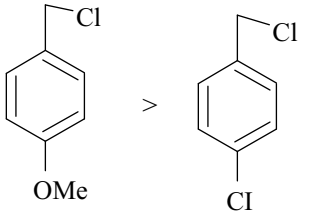
(d) 

36. Identify ccorrect reactivity order for S_N1 reaction

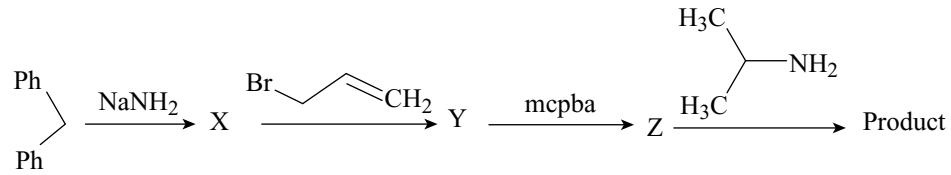
(a) 

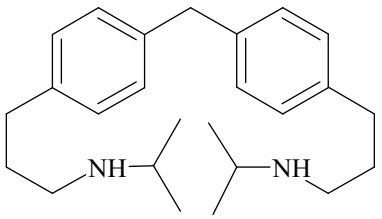
(b) 

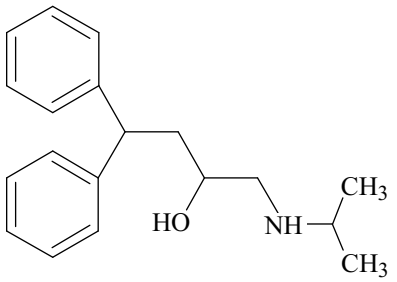
(c) 

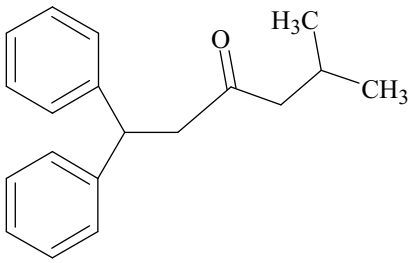
(d) 

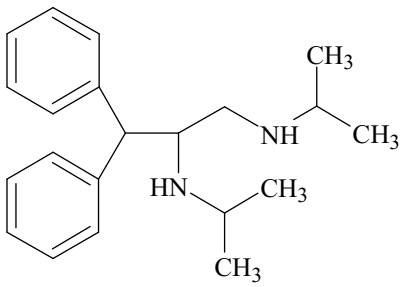
37. Identify final product in following sequence



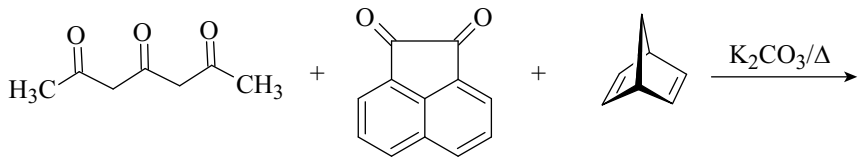
(a) 

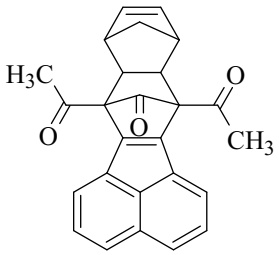
(b) 

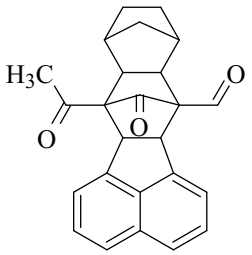
(c) 

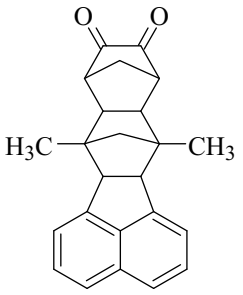
(d) 

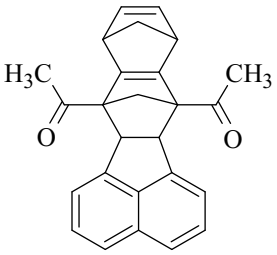
38. Identify final product of following reaction



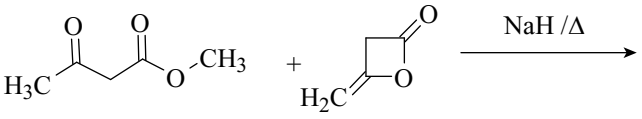
(a) 

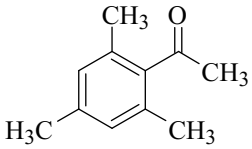
(b) 

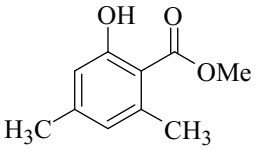
(c) 

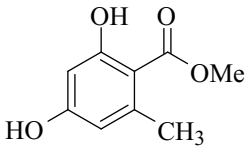
(d) 

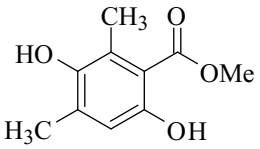
39. Identify final product of following reaction



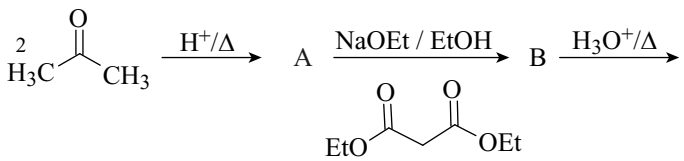
(a) 

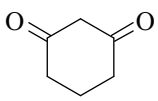
(b) 

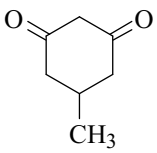
(c) 

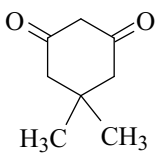
(d) 

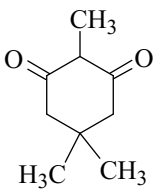
40. Identify final product of following reaction



(a) 

(b) 

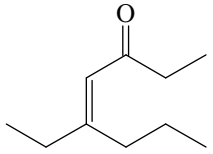
(c) 

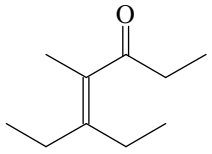
(d) 

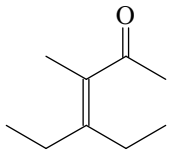
41. Select all of the following statements about the aldol experiment that are true

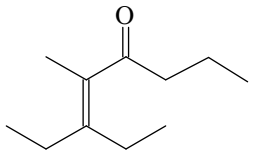
(a) The ketone was added to a solution containing the aldehyde and base.
(b) The reaction can be catalysed by acid
(c) The electrophile is the enolate ion
(d) The aldehyde is used in excess

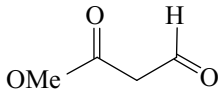
42. Which of the following structures is the product from the self-condensation of two molecules of pentan-3-one?

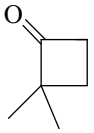
(a) 

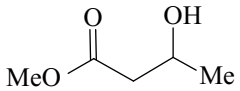
(b) 

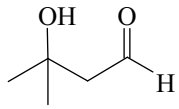
(c) 

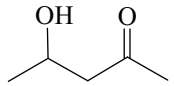
(d) 

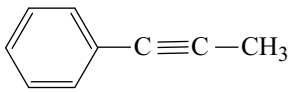
43. 

(a) 

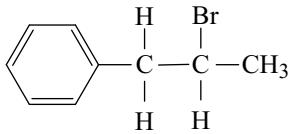
(b) 

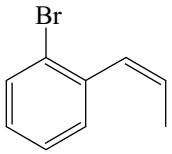
(c) 

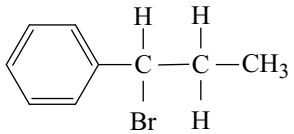
(d) 

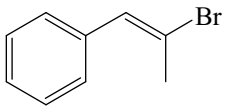
44. 

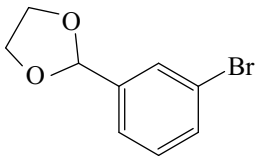
Product is

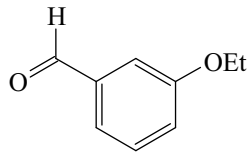
(a) 

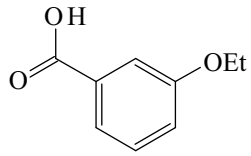
(b) 

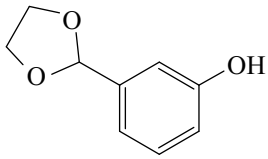
(c) 

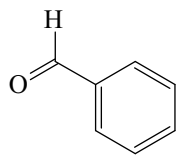
(d) 

45. 

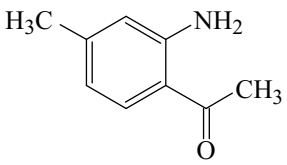
(a) 

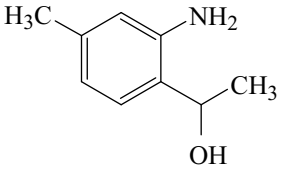
(b) 

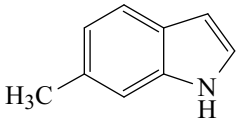
(c) 

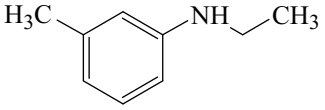
(d) 

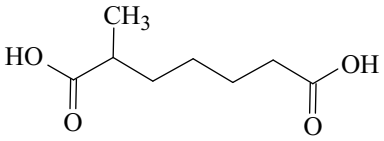
46. CH_3CO_2H $\xrightarrow[\text{(ii) 3-Methylaniline}]{\text{(i) } SOCl_2}$ $\xrightarrow[\text{(iii) } LiAlH_4\text{, then } H_3O^+]{}$

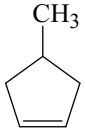
(a) 

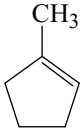
(b) 

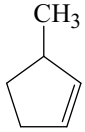
(c) 

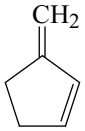
(d) 

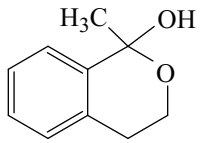
47. $\xrightarrow[\text{(ii) } NaBH_4\\ \text{(iii) Excess } PBr_3\\ \text{(iv) Excess KCN}\\ \text{(v) } H^+, H_2O \text{ and heat}]{\text{(i) } O_3\text{, then Zn in } H_2O}$ 

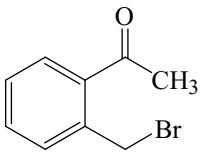
(a) 

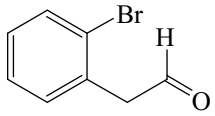
(b) 

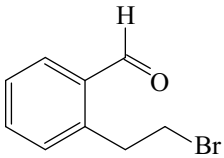
(c) 

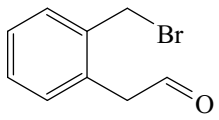
(d) 

48. $\xrightarrow[\text{(ii) Mg, THF then } H_2C{=}O\text{, then } H_3O^+\\ \text{(iii) } H_3O^+\text{, heat}]{\text{(i) HO–CH}_2\text{CH}_2\text{–OH, catalytic } H^+}$ 

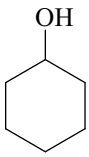
(a) 

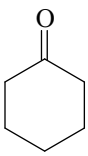
(b) 

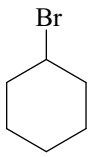
(c) 

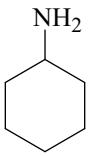
(d) 

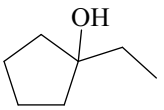
49. $\xrightarrow[\text{(ii) Cyclohexanone}\\ \text{(iii) } CH_2I_2\text{, Zn–Cu}]{\text{(i) } Ph_3P\text{, then n-BuLi}}$ 

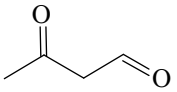
(a) 

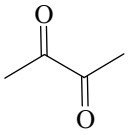
(b) 

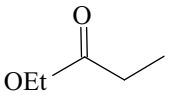
(c) 

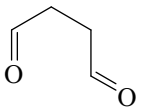
(d) 

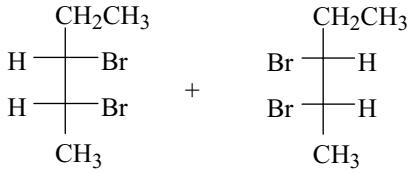
50. $BrMg–(CH_2)_4–MgBr$, then H_3O^+ → 

(a) 

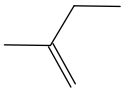
(b) 

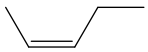
(c) 

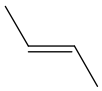
(d) 

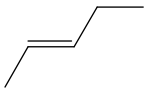
51. Br_2 → 

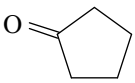
(50:50 of these enantiomers)

(a) 

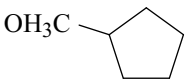
(b) 

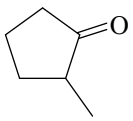
(c) 

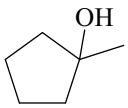
(d) 

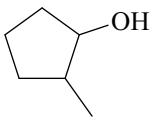
52. 

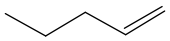
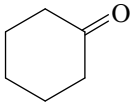
(i) LDA
(ii) CH_3I
(iii) $NaBH_4$/MeOH

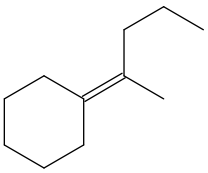
(a) 

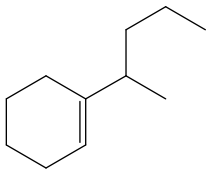
(b) 

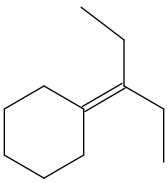
(c) 

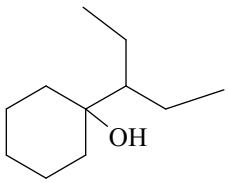
(d) 

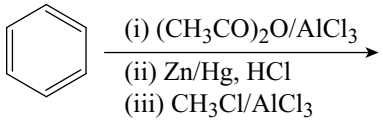
53. 
(i) HBr (dark, N_2)
(ii) PH_3P, then nBuLi
(iii) 

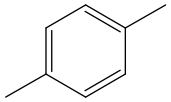
(a) 

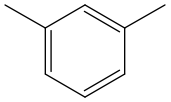
(b) 

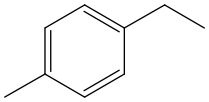
(c) 

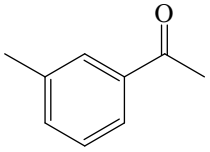
(d) 

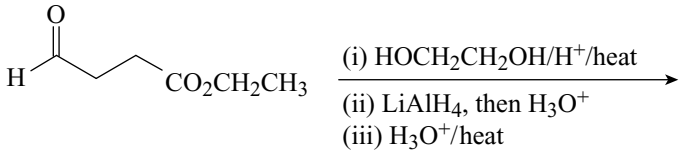
54. 

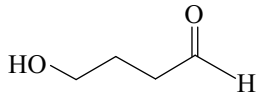
(a) 

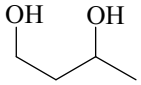
(b) 

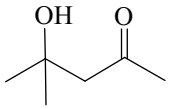
(c) 

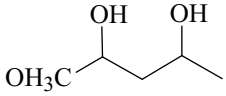
(d) 

55. 

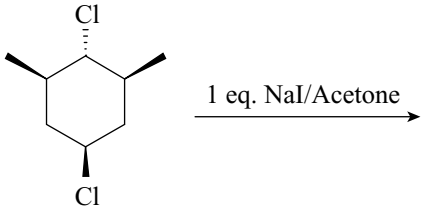
(a) 

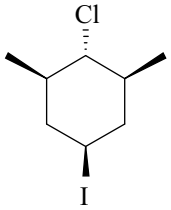
(b) 

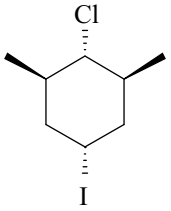
(c) 

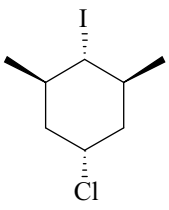
(d) 

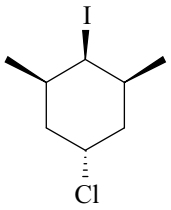
56. Identify major product for the following reaction



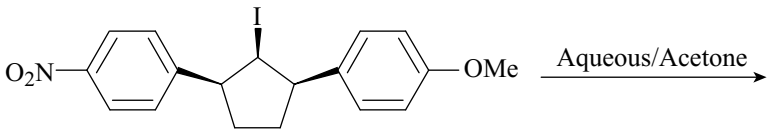
(a) 

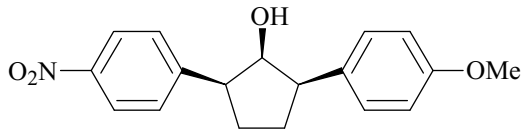
(b) 

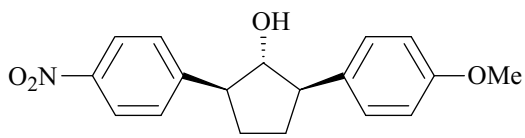
(c) 

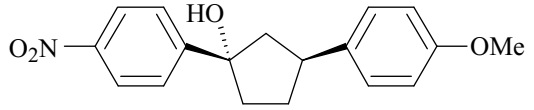
(d) 

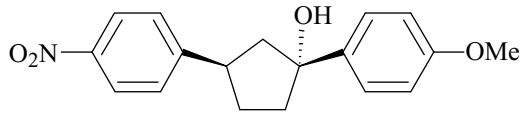
57. Identify major product for the following reaction



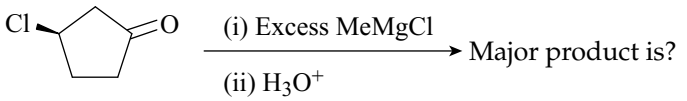
(a) 

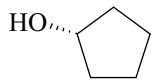
(b) 

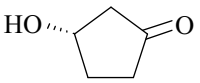
(c) 

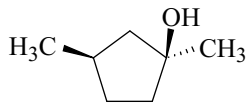
(d) 

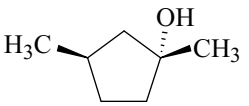
58. Identify major product for the following reaction



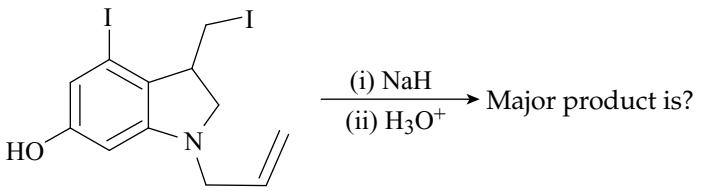
(a) 

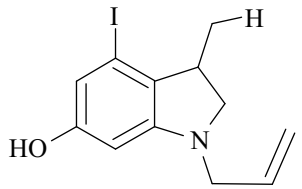
(b) 

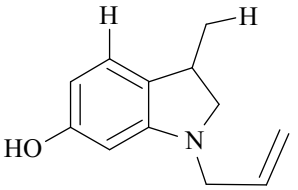
(c) 

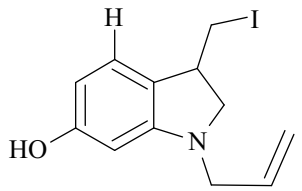
(d) 

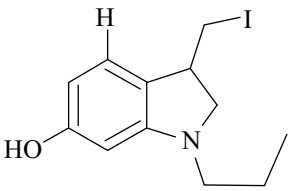
59. Identify major product for the following reaction



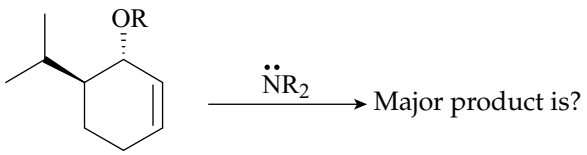
(a) 

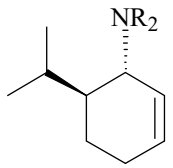
(b) 

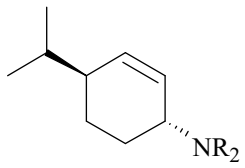
(c) 

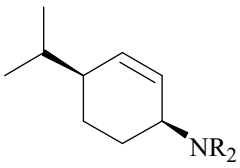
(d) 

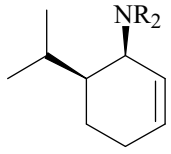
60. Identify major product for the following reaction



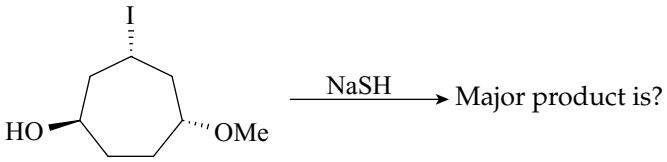
(a) 

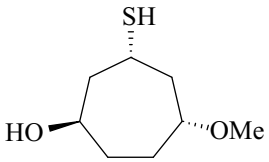
(b) 

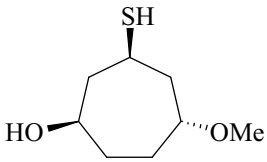
(c) 

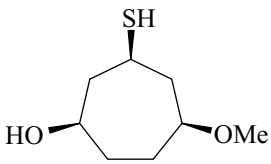
(d) 

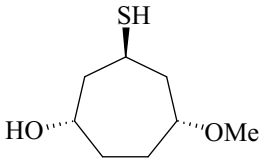
61. Identify major product for the following reaction



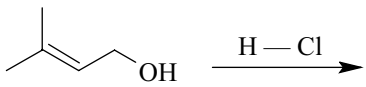
(a) 

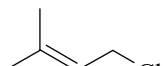
(b) 

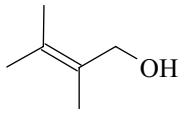
(c) 

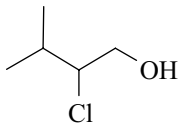
(d) 

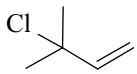
62. Choose the major product of the following reaction.



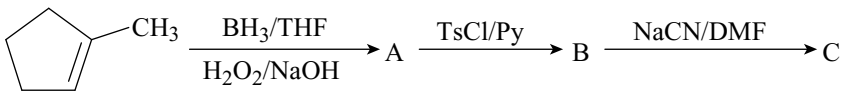
(a) 

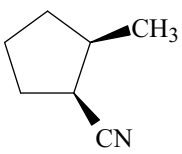
(b) 

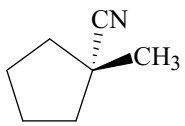
(c) 

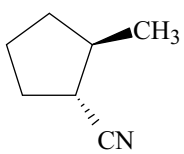
(d) 

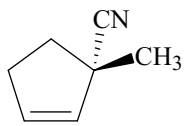
63. Identify major product of the following reaction



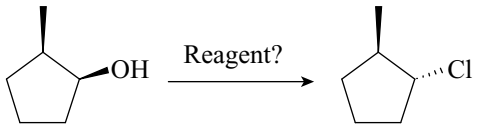
(a) 

(b) 

(c) 

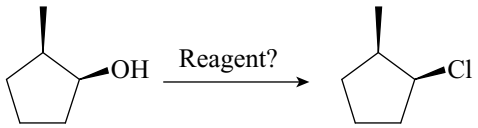
(d) 

64. Identify best reagent for the following conversion



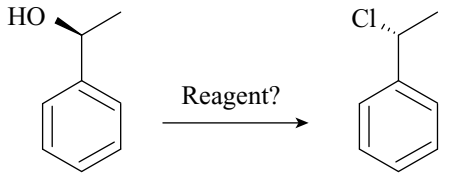
(a) $ZnCl_2/HCl$ (b) PCl_5 (c) PCl_3 (d) $SOCl_2$

65. Identify best reagent for the following conversion



(a) $ZnCl_2/HCl$ (b) PCl_5 (c) PCl_3 (d) $SOCl_2$

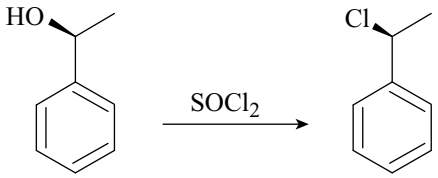
66. Identify best reagent for the following conversion



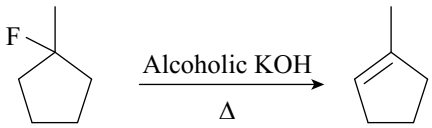
(a) $ZnCl_2/HCl$ (b) PCl_5 (c) PCl_3 (d) $SOCl_2$

67. Identify reactions that correctly match with their products

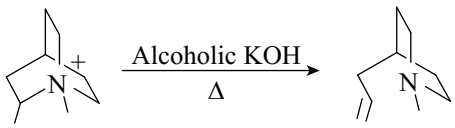
(a)



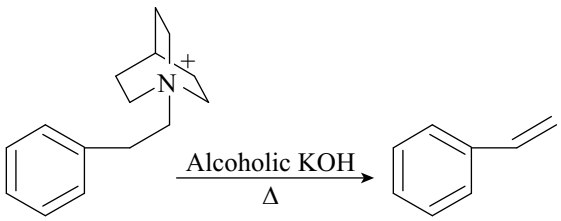
(b)



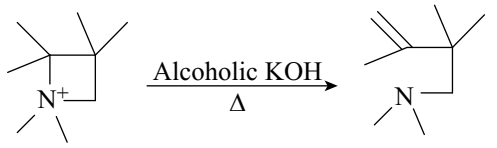
(c)

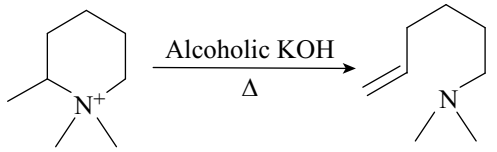


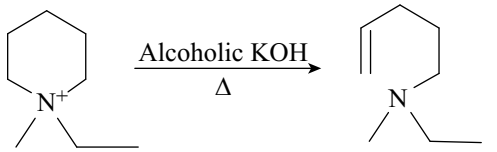
(d)

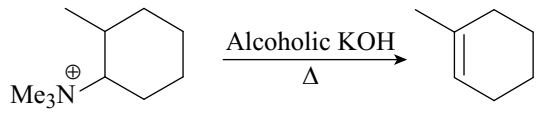


68. Identify reactions that correctly match with their products

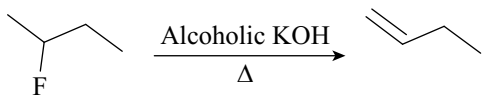
(a) 

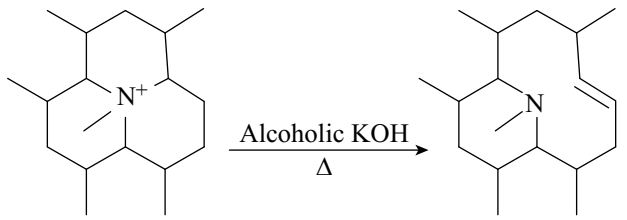
(b) 

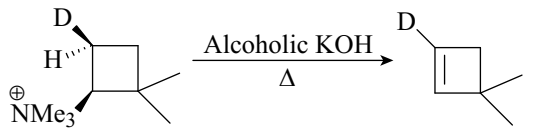
(c) 

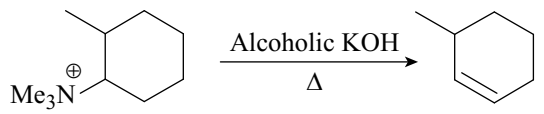
(d) 

69. Identify reactions that correctly match with their products

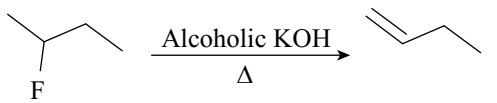
(a) 

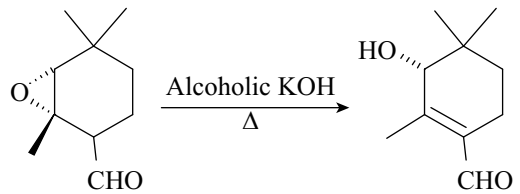
(b) 

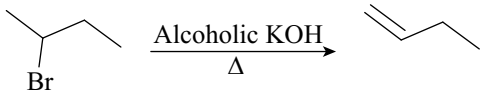
(c) 

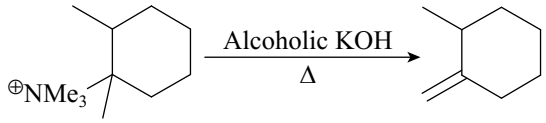
(d) 

70. Identify reactions that correctly match with their products

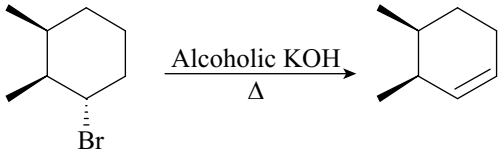
(a) 

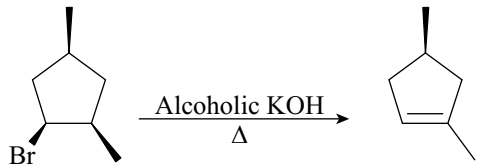
(b) 

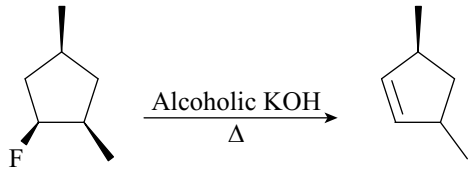
(c) 

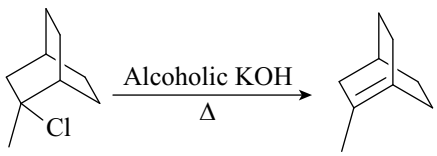
(d) 

71. Identify reactions that correctly match with their products

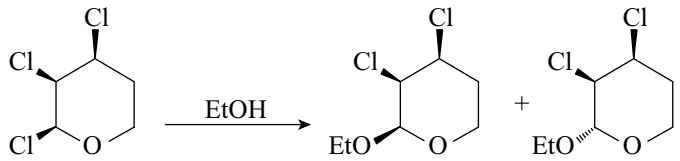
(a) 

(b) 

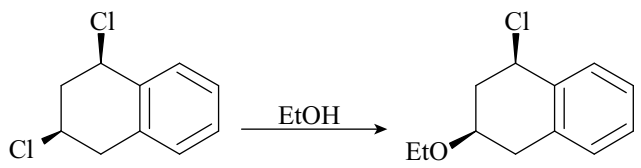
(c) 

(d) 

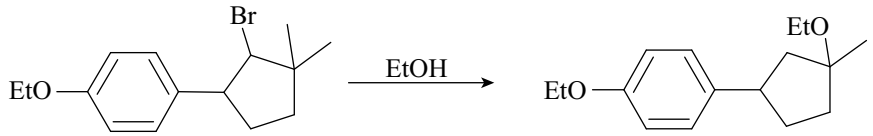
72. Identify reactions that correctly match with their products?

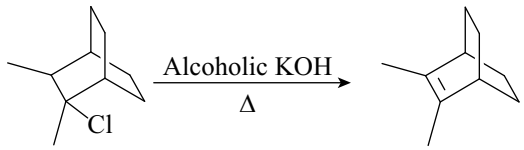
(a) 

Monosubstituted product

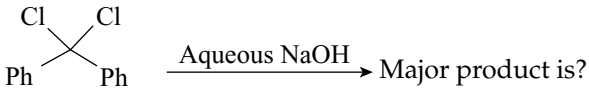
(b) 

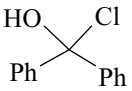
Monosubstituted product

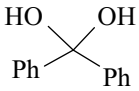
(c) 

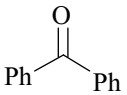
(d) 

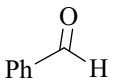
73. Identify major product for the following reaction



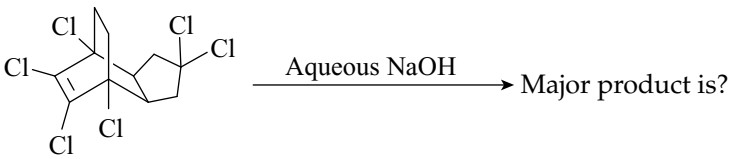
(a) 

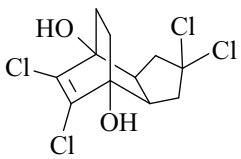
(b) 

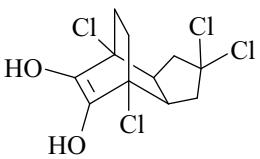
(c) 

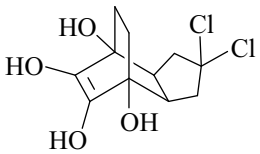
(d) 

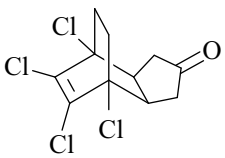
74. Identify major product for the following reaction



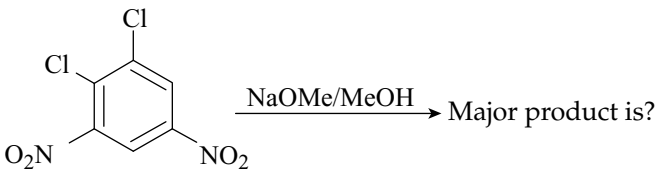
(a) 

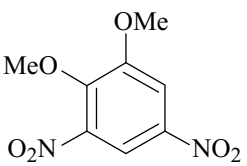
(b) 

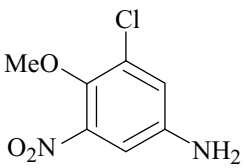
(c) 

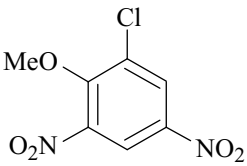
(d) 

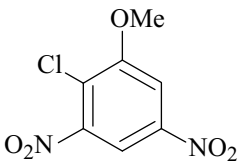
75. Identify major product for the following reaction



(a) 

(b) 

(c) 

(d) 

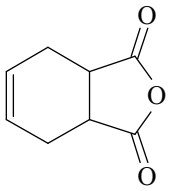
76. Identify S_N2 reaction which is favourable in a polar protic medium

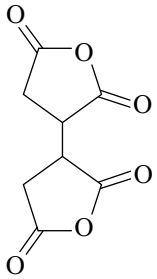
(a) $NaOH + CH_3 - I \longrightarrow HO-CH_3 + NaI$

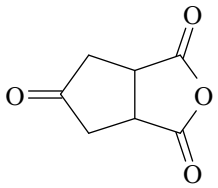
(b) $OH^- + Me - \overset{\oplus}{N}(Me)_3 \longrightarrow OH-Me + \ddot{N}Me_3$

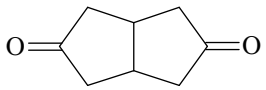
(c) $\ddot{N}H_3 + Me - \overset{\oplus}{S}(Me)_2 \longrightarrow H_2N - Me + SMe_2$

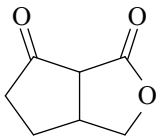
(d) $NH_3 + Me-I \longrightarrow H_2N - Me + H-I$

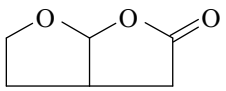
77. 

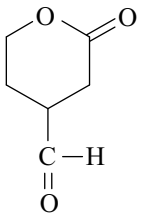
(a) 

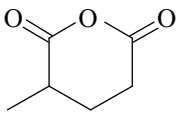
(b) 

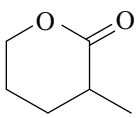
(c) 

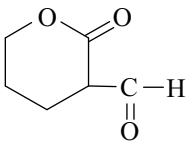
(d) 

78. 

(a) 

(b) 

(c) 

(d) 

Comprehension Type

Passage 1

Suppose, a sample of an initially pure single enantiomer of tartaric acid $[\alpha]_D^{20} = +12.4°$ (H_2O) underwent a chemical isomerization reaction which yielded 10 per cent of the other enantiomer and 20 per cent of the meso isomer, in addition to 70 per cent of the unchanged starting compound.

79. What is the enantiomeric excess (ee.) of the major enantiomer relative to the minor enantiomer?

(a) 70 per cent (b) 700 per cent
(c) 75 per cent (d) 87.5 per cent

80. If 1.0 g of the total mixture (including the meso isomer) was dissolved in 1 mL water and the rotation measured in a 1 dm cell, what value of α_D would one expect to observe?

(a) +9.92 (b) +7.44 C (c) +12.4 (d) +8.68

81. From the total mixture, chromatographic separation on silica gel (a commonly used achiral solid adsorbent) might be expected to yield one of the three components in a pure state. Which one?

(a) the minor enantiomer
(b) the meso isomer
(c) the major enantiomer
(d) the 1:1 racemic form of tartaric acid

Passage 2

(a) When 1-chloro-2-pentene is reacted with concentrated solution of sodium ethoxide, the rate of reaction depends on the concentration of both allylhalide and ethoxide ion. The product of reaction is exclusively

$$CH_3–CH_2–CH=CH–CH_2OC_2H_5$$

(b) In dilute solution of sodium ethoxide, the reaction rate is dependent only on the concentration of allylhalide.
(c) In the presence of traces of water, 1-chloro-2-pentene is slowly converted to a mixture of

1-chloro-2-pentene and 3-chloro-1-pentene

82. In case (a) the mechanism exclusively followed by reaction is

(a) S_N1 (b) S_N2 (c) E_1 (d) E_2

83. The intermediate formed in case (c) is

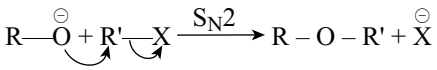
(a) $CH_3 - CH_2 - \overset{\oplus}{C}H - CH = CH_2$ (b) $CH_3 - CH_2 - CH = CH - \overset{\oplus}{C}H_2$
(c) both (a) and (b) (d) none

84. Correct statement is

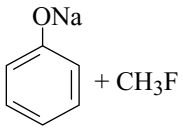
(a) The solvolysis of 1-chloro-2-pentene is greater than 1-chloropentane in water
(b) The solvolysis of 1-chloro-2-pentene is lesser than 1-chloropentane in water
(c) The solvolysis of 1-chloro-2-pentene and 1-chloropentane is equal in water
(d) The solvolysis of 1-chloro-2-pentene and 1-chloropentane do not take place in water

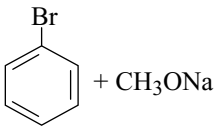
Passage 3

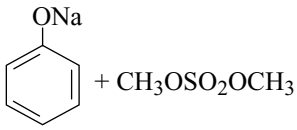
Williamson's ether synthesis is one of the best method to prepare ether. In this method ethers can be prepared by the reaction of alkoxides with alkyl halide. The reaction takes place by S_N2 mechanism. The more basic alkoxide ion displaces the halide or other leaving group to produce ether. While going for Williamson's ether synthesis one should be aware of competitive reactions. The mechanism take palces as



85. Which combination will be better to prepare anisole

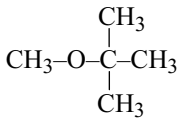
(a) 

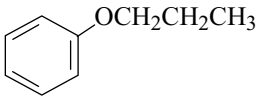
(b) 

(c) 

(d) Both (a) and (c) can be used

86. The ether that cannot be synthesized by the above method is

(a) 

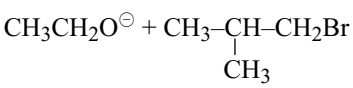
(b) 

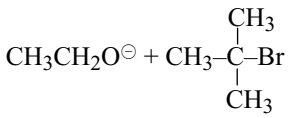
(c) $(CH_3)_3C–O–C(CH_3)_3$

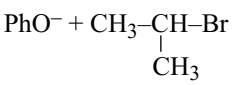
(d) All can be prepared

87. Which one of the following will give most effective yield of ether?

(a) $CH_3CH_2O^- + CH_3CH_2CH_2CH_2Br$

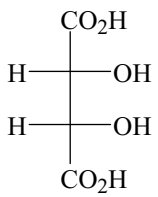
(b) 

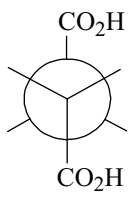
(c) 

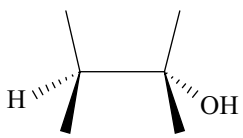
(d) 

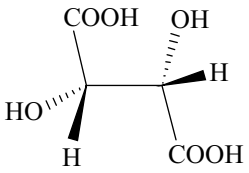
Passage 4

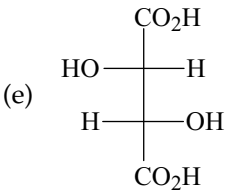
The specific rotation of (2R, 3R) – (+) – tartaric acid is +12.4° (c = 2, H_2O). The optical rotation of a solution made up from 10 g of a mixture B and C in 20 ml of water was measured in a 10 cm cell. The observed rotation was –3.1°.

(a) 

(b) 

(c) 

(d) 

(e) 

88. What is the specific rotation of A?

(a) +12.4° (b) 0°
(c) –12.4° (d) None of these

89. What is the specific rotation of the mixture?

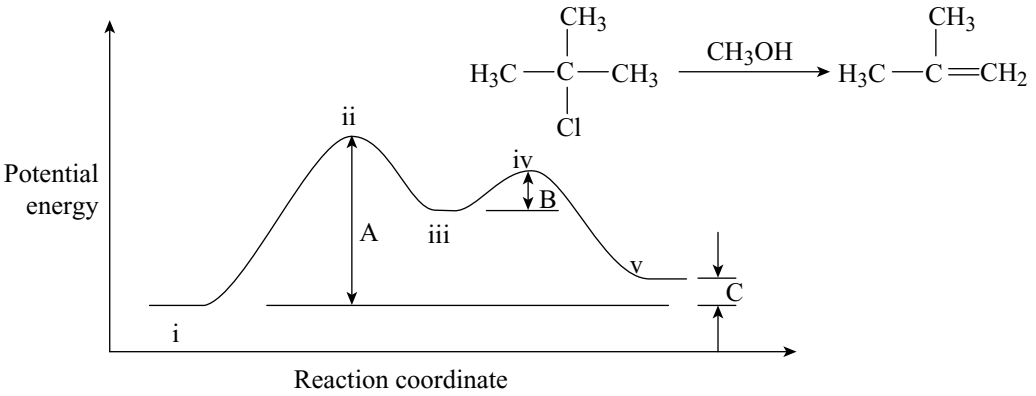
(a) –3.1° (b) –6.2° (c) –0.62° (d) +12.4°

90. What is the relative ratio of B:C in the mixture?

(a) 0:100 (b) 50:50 (c) 25:75 (d) 75:25

Passage 5

Based on the potential energy diagram for the following reaction



91. Is this an endothermic or exothermic reaction?

(a) exothermic
(b) There is not enough information to determine.
(c) endothermic
(d) This reaction can be either exothermic or endothermic.

92. What potential energy difference represents the heat of reaction?

(a) A (b) B
(c) C (d) Both A and B

93. Which of the following indicates the location of intermediate?

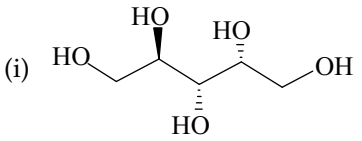
(a) i (b) ii (c) iii (d) iv

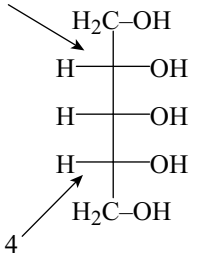
94. According to the potential energy diagram, what is the possible mechanism for the reaction?

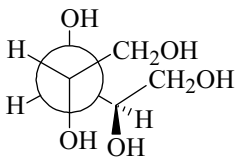
(a) E_1 (b) E_2 (c) S_N1 (d) S_N2

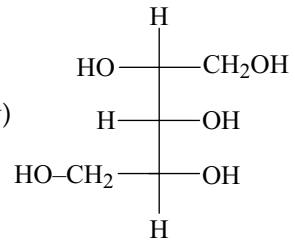
Passage 6

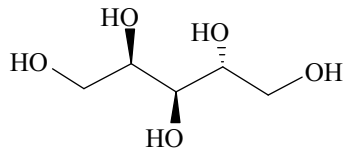
Based on the following five structures (i–v) shown below, answer questions 99 to 106.

(i) 

(ii) 

(iii) 

(iv) 

(v) 

95. What type of isomers are (i) and (iv)?

(a) diastereomers (b) conformational
(c) identical (d) enantiomers

96. What type of isomers are (i) and (iii)?

(a) diastereomers (b) conformational
(c) identical (d) enantiomers

97. If the specific rotation of i is –60.0°, what is the specific rotation of iii, if 1.0 g of iii is dissolved in 10 mL of methanol and placed in a 1 dm tube?

(a) +60° (b) 0° (c) 6° (d) –60°

98. If the specific rotation of i is –60.0°, what is the specific rotation of iv, if 1.0 g of iv is dissolved in 10 mL of methanol and placed in a 1 dm tube?

(a) +60° (b) 0° (c) 6° (d) –60°

99. If the specific rotation of (i) is –60.0°, what is the observed rotation of a sample made up of a mixture of 1 g of (i) and 0.5 g of (v) when dissolved in water (10 mL) and placed in a 10 cm cell?

(a) 60° (b) 0° (c) 6° (d) –60°

100. If the specific rotation of i is –60.0°, what is the optical purity of a sample of made up of a mixture of 1 g of (i) and 0.5 g of (v) when dissolved in water (10 mL)?

(a) 50 per cent (b) 33 per cent (c) 100 per cent (d) 66 per cent

101. Assign the absolute configuration to carbon atoms 2 and 4 in compound (ii).

(a) 2R, 4S (b) 2S, 4S (c) 2S, 4R (d) 2R, 4R

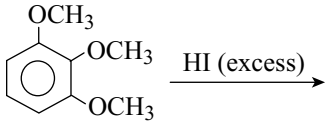
102. If the melting point of pure iv is 152°C, what is the melting point of pure (v)?

(a) –152°C (b) 152°C
(c) lower than 152°C (d) higher than 152°C

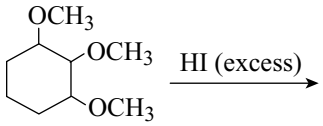
Matrix Type

Match the reaction mechanism in Column I with their reaction conditions in Column II

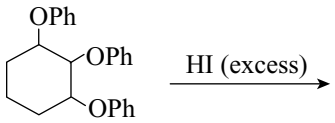
103. **Column I** **Column II**

(a) 

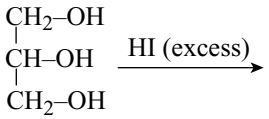
(p) More than 4 moles of HI will be consumed

(b) 

(q) Product will react with Na

(c) 

(r) Product formed contains 2° halide

(d) 

(s) CH_3I is one of the product

104.

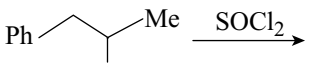
Column I	**Column II**
(a) S_N1	(p) 3° alkyl halides > 2° alkyl halides > 1° alkyl halides
(b) S_N2	(q) 1° alkyl halides > 2° alkyl halides > 3° alkyl halides
(c) E_1	(r) High concentration of strong base
(d) E_2	(s) Favourable medium is polar protic solvent

105.

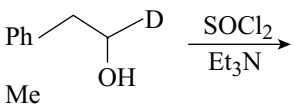
Column I	**Column II**
(a) Walden inversion	(p) Syn-addition
(b) Racemic mixture	(q) Anti-addition
(c) Alkene $\xrightarrow[\text{reagent}]{\text{Bayer's}}$	(r) S_N1 reaction
(d) Alkene $\xrightarrow{Br_2}$	(s) S_N2 reaction

106. **Column I (reaction)** **Column II**

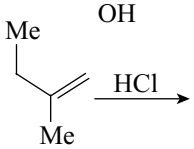
(comment on major product and intermediate)

(a) 

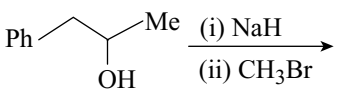
(p) Optically active compound

(b) 

(q) Inversion of configuration

(c) 

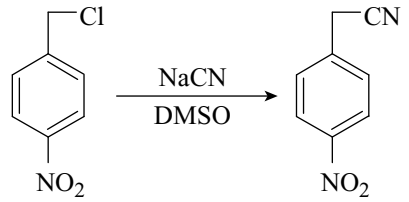
(r) Retention of configuration

(d) 

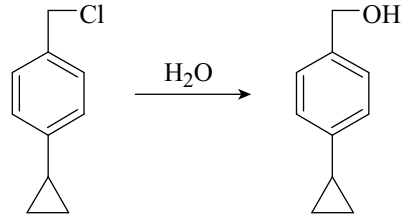
(s) Optically inactive compound

(t) Carbocation intermediate

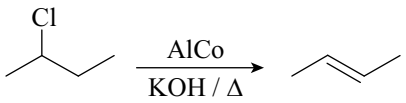
107. **Column I** **Column II**

(a) 

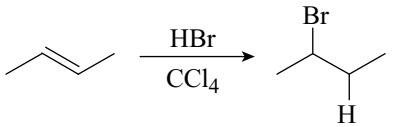
(p) Carbocation intermediate is formed

(b) 

(q) S_N1

(c) 

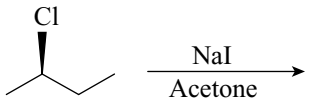
(r) S_N2

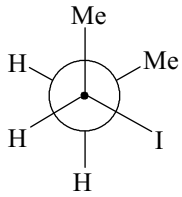
(d) 

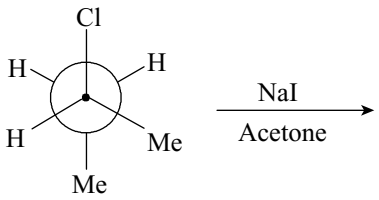
(s) Addition reaction

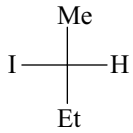
(t) Elimination reaction

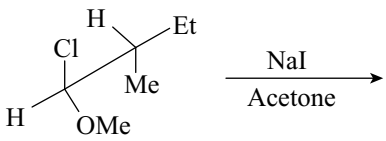
108. **Column I** **Column II**

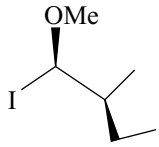
(a) 

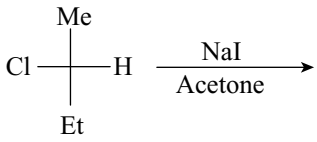
(p) 

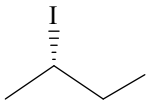
(b) 

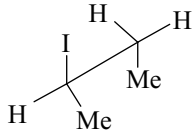
(q) 

(c) 

(r) 

(d) 

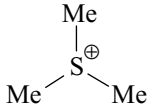
(s) 

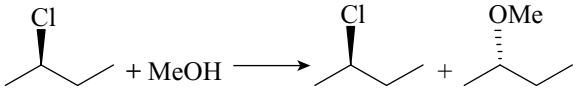
(t) 

109. **Column I** **Column II**

(a) $NaOH + H_3C—Cl \longrightarrow HO—CH_3 + NaCl$

(b) $NH_3 + H_3C—Cl \longrightarrow H_2N—CH_3 + HCl$

(c) $NH_3 +$  $\longrightarrow H_2N—Me + SMe_2$

(d) 

(p) Rate of reaction increases in polar protic solvent

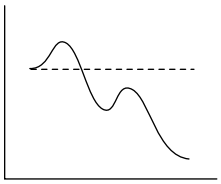
(q) Rate of reaction increases in polar aprotic solvent

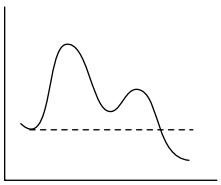
(r) S_N2 mechanism

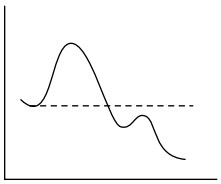
(s) S_N1 mechanism

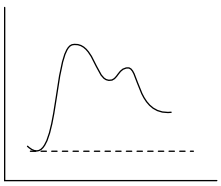
(t) TS has positive charge [non-zwitter ion]

110. **Column I**
(energy profile)

(a) 

(b) 

(c) 

(d) 

Column II
(chain propagation of halogenation)

(p) Iodination

(q) Fluorination

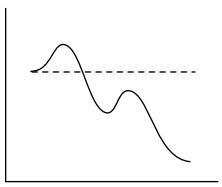
(r) Chlorination

(s) Bromination

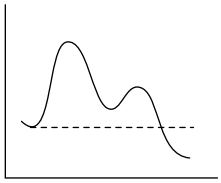
111. **Column I**
(RDS of halogenation)

(a) $R – H + F\bullet \longrightarrow R\bullet + H – F$

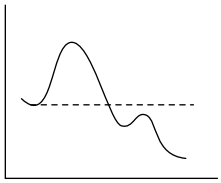
Column II
(energy profile)

(p) 

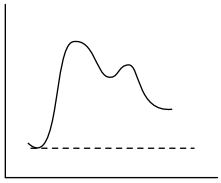
(b) $R - H + Cl\bullet \longrightarrow R\bullet + H - Cl$ (q)



(c) $R - H + Br\bullet \longrightarrow R\bullet + H - Br$ (r)

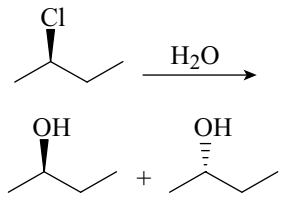


(d) $R - H + I\bullet \longrightarrow R\bullet + H - I$ (s)

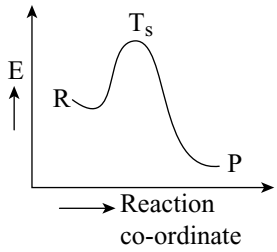


112. Column I **Column II**

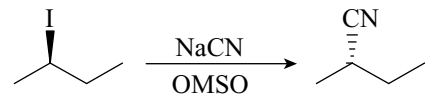
(a)



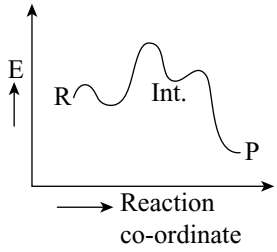
(p)



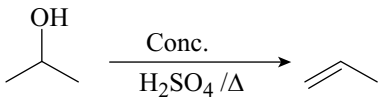
(b)



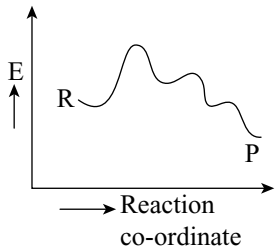
(q)



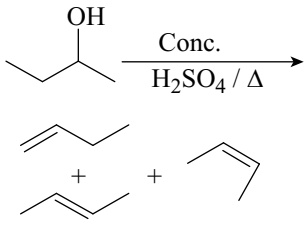
(c)



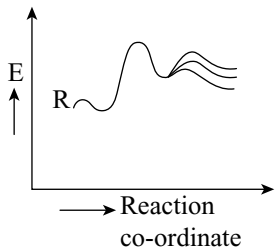
(r)



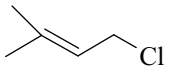
(d)



(s)

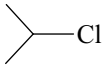


113. **Column I (compounds)** | **Column II (rate of solvolsis)**

(a)  (p) 0.07

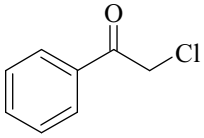
(b)  (q) 0.12

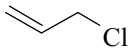
(c)  (r) 2100

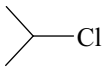
(d)  (s) 130000

114. **Column I (compound)** | **Column II (rate of reaction with NaI acetone)**

(a) Me–Cl (p) 0.02

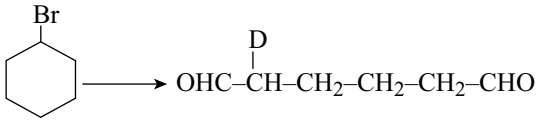
(b)  (q) 100000

(c)  (r) 200

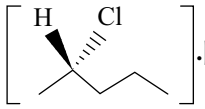
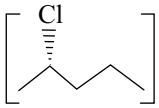
(d)  (s) 79

Integer Type

115. Minimum number of steps involved in conversion of



116. When (S)-2-chloropentane reacts with NaOH in 75 per cent EtOH and 25 per cent acetone follows rate law:

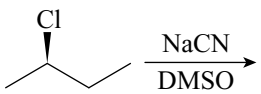
$$\text{Rate} = 2.35 \times 10^{-5}$$  $$.[OH] + 5.30 \times 10^{-6}$$ 

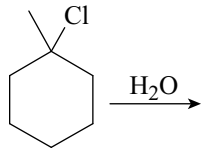
Then, calculate percentage of S_{N1} product when concentration of [OH] = 1.5 molar.

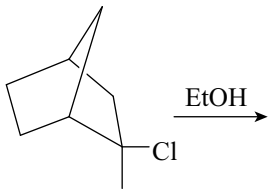
If percentage of S_N1 product = X, then calculate value of Y if:

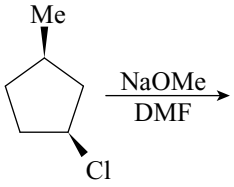
Y= X – 5.

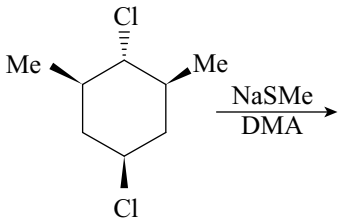
117. Identify total number of S_N1 reactions

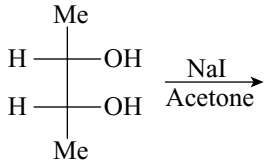
(i) 

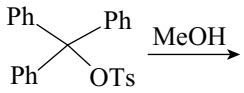
(ii) 

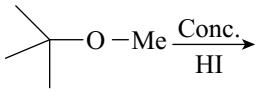
(iii) 

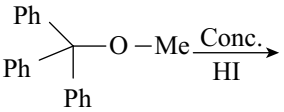
(iv) 

(v) 

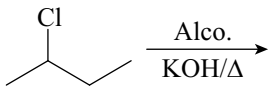
(vi) 

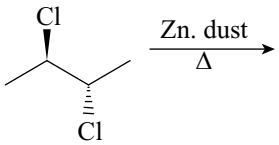
(vii) 

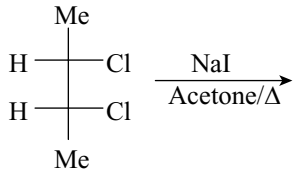
(viii) 

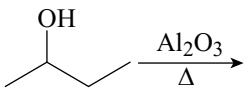
(ix) 

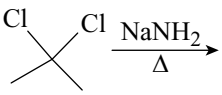
118. Identify total number of 'β'-elimination reactions

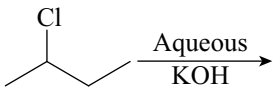
(i) 

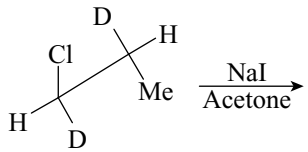
(ii) 

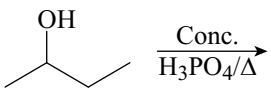
(iii) 

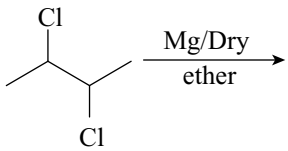
(iv) 

(v) 

(vi) 

(vii) 

(viii) 

(ix) 

119. Calculate percentage of S_N1 product if (R) -2-chloro butane on reaction with $NaOH/H_2O$ and acetone gives 98 per cent inverted product.

120. Calculate total number of alkene products when 2-chloro-2-cyclobutyl hexane react with alcoholic KOH and heat.

121. Calculate total number of α-H present in alkene formed when 2, 3-dimethyl butanol react with concentrated H_2SO_4/Δ.

Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	b	c	c	a	d	c	b	d	c	a	b	c	a	d
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
a	d	d	d	d	c	c	d	b	c	b	c	d	d	d
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
b	d	d	b	a	d	c	d	d	b	a	b	a	c	c
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	a	d	a	d	c	b	d	a	c	a	b	a	d
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	a	d	b	a	a	b	b	d	c	b	b	b	a	a
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
c	b	a	c	d	d	d	a	a	a	b	a	a	a	b
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
d	a	d	b	c	a	a	b	b	a	b	b	b	d	b
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	d	a	c	d	c	d	c	a	d	c	cd	a	d	c
121	122	123	124	125	126	127	128	129	130					
d	b	d	a	b	b	c	b	bc	d					

LEVEL 2

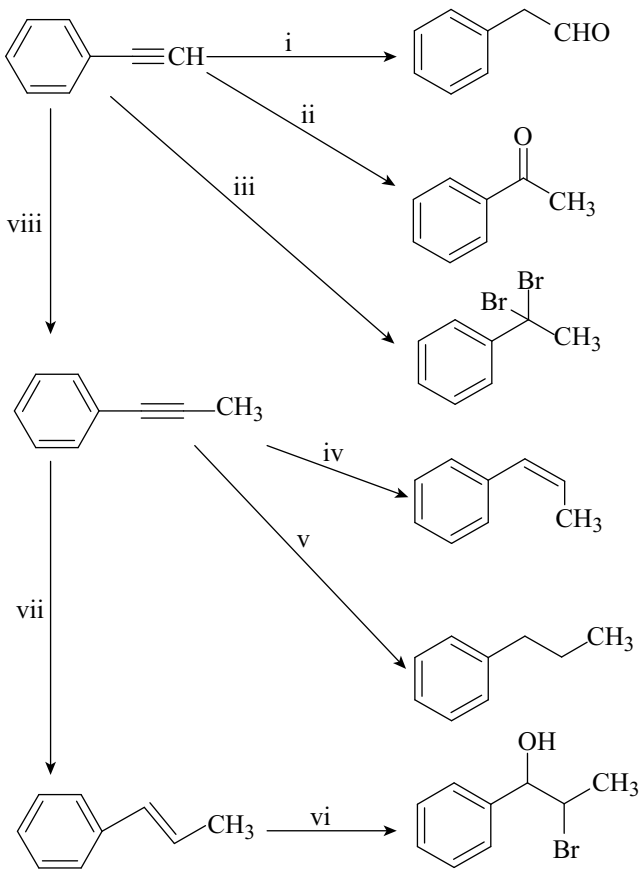
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
bd	a	a	a	d	ab	bcd	a	ac	acd	ad	abc	bcd	abc	bc
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
d	abc	ab	ac	a	abd	b	b	a	c	a	c	a	a	c
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
d	d	d	d	abd	cd	b	a	c	c	abd	b	c	c	d
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	b	a	c	c	d	d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

d	ab	a	c	a	d	b	c	a	c	c	a	bcd	b	d
91	92	93	94	95	96	97	98	99	100	101	102	103(a)	103(b)	103(c)
c	c	c	a	d	a	b	a	d	c	ac	b	qs	pqrs	pqr
103(d)	104(a)	104(b)	104(c)	104(d)	105(a)	105(b)	105(c)	105(d)	106(a)	106(b)	106(c)	106(d)	107(a)	107(b)
pqr	ps	qr	ps	pr	s	r	p	q	prt	pq	st	pr	r	pq
107(c)	107(d)	108(a)	108(b)	108(c)	108(d)	109(a)	109(b)	109(c)	109(d)	110(a)	110(b)	110(c)	110(d)	111(a)
t	ps	ps	ps	r	s	qr	prt	qrt	pst	q	s	r	p	p
111(b)	111(c)	111(d)	112(a)	112(b)	112(c)	112(d)	113(a)	113(b)	113(c)	113(d)	114(a)	114(b)	114(c)	114(d)
r	q	s	r	p	q	s	s	r	p	q	r	q	s	p
115	116	117	118	119	120	121								
5	8.233	5	6	4	4	12								

WORKBOOK EXERCISES

EXERCISE 1

Conversion



Reagents

(A) BH_3/THF, then NaOH, H_2O_2, H_2O

(B) H_3O^+

(C) $HgSO_4$/aq. H_2SO_4

(D) CH_3I

(E) Excess HBr

(F) CH_3CH_2I

(G) Br_2/CCl_4

(H) NaOH

(I) H_2/Pd

(J) Br_2/H_2O

(K) H_2/Pd/$CaCO_3$/Pb

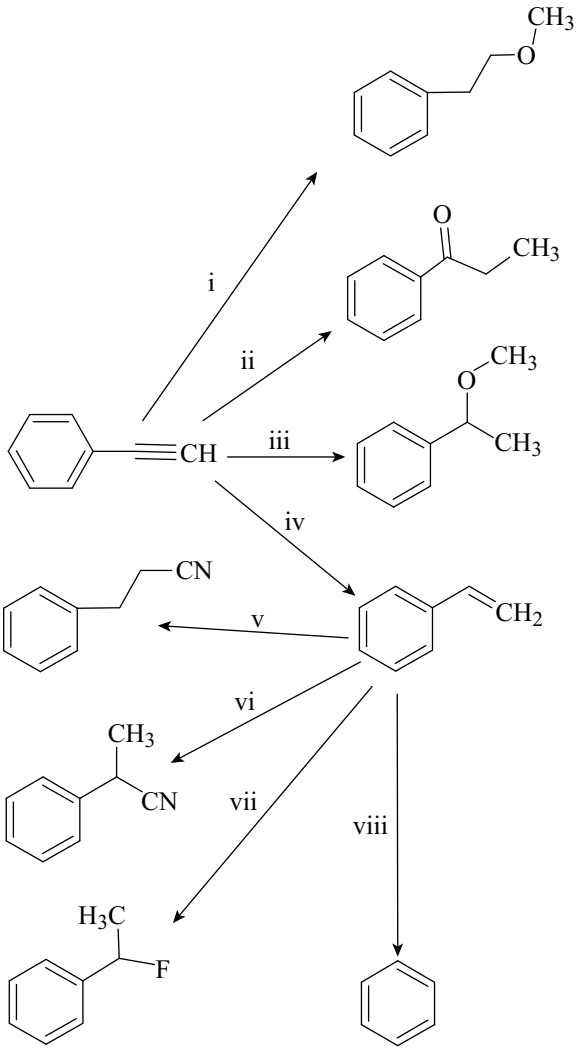
(L) HBr/UV light

(M) $NaNH_2/NH_3$ (i)

(N) Na/NH_3 (i)

EXERCISE 2

Conversion



Reagents

(A) $HgSO_4$, aq. H_2SO_4
(B) (i) $NaNH_2$ then add MeI
(ii) $HgSO_4$, aq. H_2SO_4
(C) (i) $NaNH_2$, then add MeI
(ii) BH_3, then H_2O_2, NaOH, H_2O
(D) (i) BH_3, then H_2O_2, NaOH, H_2O
(ii) Na then MeI
(E) (i) H_2/Lindlar's catalyst
(ii) BH_3, then H_2O_2, NaOH, H_2O
(iii) MeOH
(F) (i) H_2/Lindlar's catalyst
(ii) BH_3, then H_2O_2, NaOH, H_2O
(iii) Na then MeI
(G) (i) H_2/Lindlar's catalyst
(ii) aq. H_2SO_4
(iii) MeOH
(H) (i) H_2/Lindlar's catalyst
(ii) aq. H_2SO_4
(iii) Na, then MeI
(I) (i) aq. H_2SO_4 (ii) Na, then MeI
(J) Na in NH_3 (l)
(K) H_2/Lindlar's catalyst
(L) H_2/Pd
(M) HCN
(N) (i) H_2/Pd (ii) NaCH/DMSO
(O) (i) aq. H_2SO_4 (ii) NaCN/DMSO
(P) (i) HBr, H_2SO_2 (ii) NaCN/DMSO
(Q) HF/Pyridine
(R) (i) H_2/Pd or Ni (ii) NaF/DMSO
(S) (i) HBr, H_2O_2 (ii) NaF/DMSO
(T) (i) HBr (dark, N_2) (ii) NaF/EtOH
(U) (i) HBr (dark, N_2) (ii) NaF/DMSO
(V) (i) HBr H_2O_2 (ii) H_2S
(W) (i) HBr, (dark, N_2) (ii) H_2S
(X) H_2S/EtOH
(Y) (i) HBr (dark, N_2) (ii) NaCN/DMSO

EXERCISE 3

There are 18 alkene isomers with the molecular formula C_6H_{12}, and they are all drawn (A-R) in the box at the bottom of this page. You are presented with five flasks (1 to 5), each one containing a single pure sample of one of these alkenes. In a very long and excruciating lab class one afternoon, you run two separate reactions on each sample (i) ozonolysis (O_3 followed by Me_2S) and (ii) bromination (Br_2/CCl_4). For the ozonolysis reactions, you analyse what kind of stereoisomers (if any) are formed in each reaction. The results of the two reactions for each flask are summarized below that flask. Using your knowledge of alkene reactions, identify each sample (1 to 5) as as ONE of the alkenes drawn below (A-R) by writing that letter in the small box below:

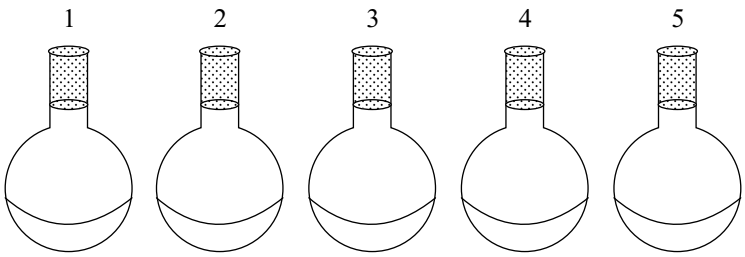
Key

Racemic mixture (Rac)

Diastereoisomers (Dia)

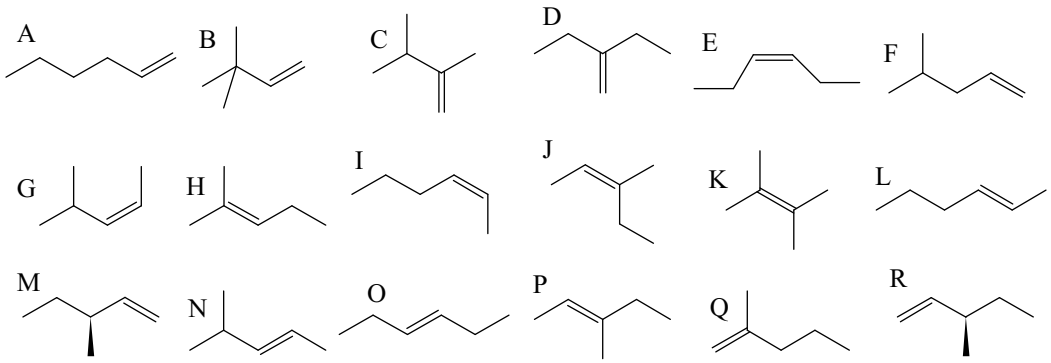
Achiral meso compound

Achiral, non-meso compound (Ach)



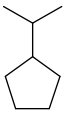
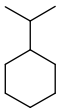
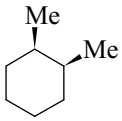
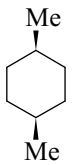
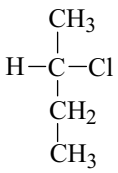
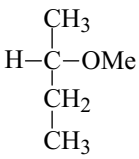
	1	2	3	4	5
Number of unique ozonolysis (O_3) products	One	One	One	Two	Two
Reaction with Br_2 in CCl_4 gives	Ach	Rac	Meso	Ach	Dia
IDENTITY OF SAMPLE ⇨	☐	☐	☐	☐	☐

Note: For one of the samples, there are two correct answers, but you only need to indicate one of them.



EXERCISE 4

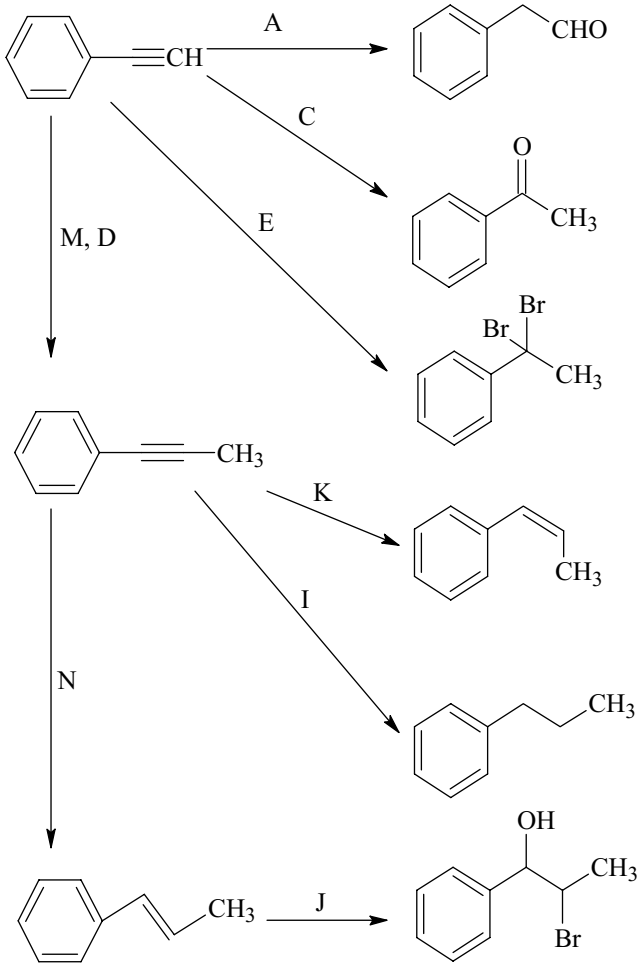
Match alkanes with their products.

Alkanes	Total Number of Mono-chloro Products	Total Number of Mono-chloro Fractions After Distillation
(i) 	(A) 6	(a) 2
(ii) 	(B) 12	(b) 3
(iii) 	(C) 14	(c) 4
(iv) 	(D) 16	(d) 5
(v) 	(E) 8	(e) 6
	(F) 4	(f) 7
(vi) 	(G) 5	(g) 8
(vii) 	(H) 10	(h) 9
	(I) 8	(i) 10
(viii) 	(J) 16	(j) 11
	(K) 7	(k) 12
(ix) 	(L) 5	(l) 13
	(M) 13	(m) 14
(x) 	(N) 3	(n) 16

Solution for Workbook Exercises

EXERCISE 1

Conversion



Reagents

(A) BH_3/THF then NaOH, H_2O_2, H_2O

(B) H_3O^+

(C) $HgSO_4$/aq. H_2SO_4

(D) CH_3I

(E) Excess HBr

(F) CH_3CH_2I

(G) Br_2/CCl_4

(H) NaOH

(I) H_2/Pd

(J) Br_2/H_2O

(K) $H_2/Pd/CaCO_3$

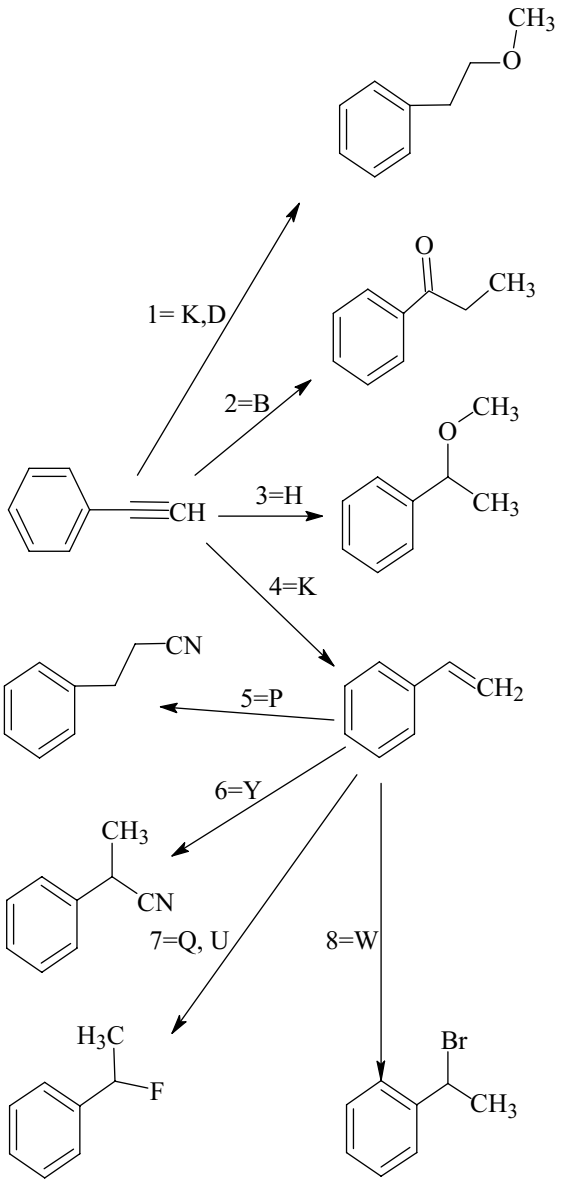
(L) HBr/uv light

(M) $NaNH_2/NH_3$ (l)

(N) Na/NH_3 (l)

EXERCISE 2

Conversion



Reagents

(A) $HgSO_4$, aq. H_2SO_4
(B) (i) $NaNH_2$ then add MeI.
(ii) $HgSO_4$, aq. H_2SO_4
(C) (i) $NaNH_2$ then add MeI.
(ii) BH_3, then H_2O_2, NaOH, H_2O
(D) (i) BH_3, then H_2O_2, NaOH, H_2O
(ii) Na then MeI
(E) (i) H_2 / Lindlar catalyst.
(ii) BH_3, then H_2O_2, NaOH, H_2O
(iii) MeOH
(F) (i) H_2 / Lindlar catalyst.
(ii) BH_3, then H_2O_2, NaOH, H_2O
(iii) Na then MeI
(G) (i) H_2 / Lindlar catalyst.
(ii) aq. H_2SO_4
(iii) MeOH
(H) (i) H_2 / Lindlar catalyst.
(ii) aq. H_2SO_4
(iii) Na then MeI
(I) (i) aq. H_2SO_4
(ii) Na then MeI
(J) Na in NH_3 (l)
(K) H_2 / Lindlar catalyst.
(L) H_2 / Pd
(M) HCN
(N) (i) H_2 / Pd.
(ii) NaCN / DMSO
(O) (i) aq. H_2SO_4
(ii) NaCN / DMSO
(P) (i) HBr, H_2O_2
(ii) NaCN / DMSO
(Q) HF / Pyridine
(R) (i) H_2 / Pd or Ni.
(ii) NaF / DMSO
(S) (i) HBr, H_2O_2
(ii) NaF / DMSO
(T) (i) HBr (dark, N_2)
(ii) NaF / EtOH
(U) (i) HBr (dark, N_2)
(ii) NaF / DMSO
(V) (i) HBr, H_2O_2
(ii) H_2S
(W) (i) HBr (dark, N_2)
(ii) H_2S
(X) H_2S / EtOH
(Y) (i) HBr (dark, N_2)
(ii) NaCN / DMSO

EXERCISE 3

There are 18 alkene isomers with the molecular formula C_6H_{12}, and they are all drawn (A-R) in the box at the bottom of this page. You are presented with five flasks (1 to 5), each one containing a single pure sample of one of these alkenes. In a very long and excruciating lab class one afternoon, you run two separate reactions on each sample (i) ozonolysis (O_3 followed by Me_2S), and (ii) bromination (Br_2/CCl_4). For the ozonolysis reactions, you analyse what kind of stereoisomers (if any) are formed in each reaction. The results of the two reactions for each flask are summarized below that flask. Using your knowledge of alkene reactions, identify each sample (1 to 5) as ONE of the alkenes drawn below (A-R) by writing that letter in the small box below:

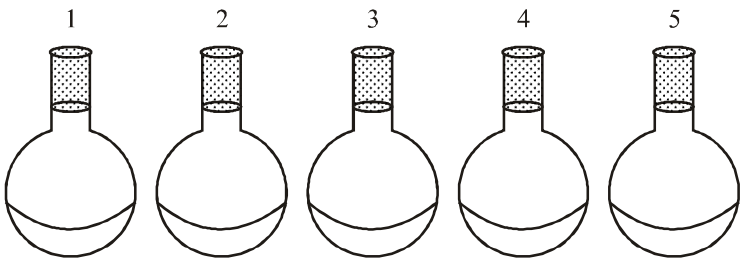
Key

Racemic mixture (Rac)

Diastereoisomers (Dia)

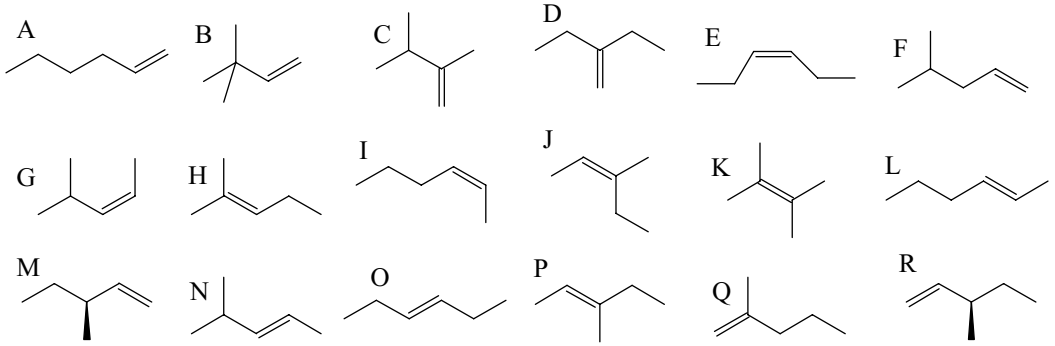
Achiral meso compound

Achiral, non-meso compound (Ach)

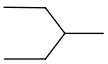
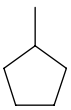
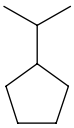
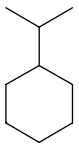
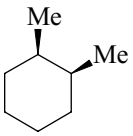
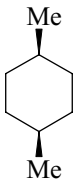
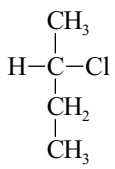
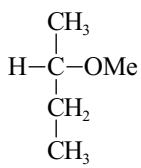


	1	2	3	4	5
Number of Unique Ozonolysis (O_3) Products	One	One	One	Two	Two
Reaction with Br_2 in CCl_4 gives	Ach	Rac	Meso	Ach	Dia
IDENTITY OF SAMPLE ⇨	K	E	O	D	M, R

Note: For one of the samples, there are two correct answers, but you only need to indicate one of them.



EXERCISE 4

Alkanes		Total Number of Mono-chloro Products	Total Number of Mono-chloro Fractions After Distillation
(i) 	--A,c	(A) 6	(a) 2
(ii) 	--E,d	(B) 12	(b) 3
(iii) 	--N,a	(C) 14	(c) 4
(iv) 	--H,e	(D) 16	(d) 5
(v) 	--B,f	(E) 8	(e) 6
(vi) 	--C,g	(F) 4	(f) 7
(vii) 	--C,f	(G) 5	(g) 8
		(H) 10	(h) 9
		(I) 8	(i) 10
(viii) 	--K,d	(J) 16	(j) 11
		(K) 7	(k) 12
(ix) 	--L,d	(L) 5	(l) 13
		(M) 13	(m) 14
		(N) 2	(n) 16
(x) 	--K,e		