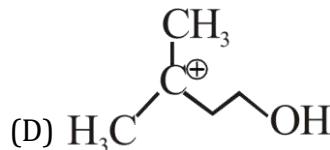
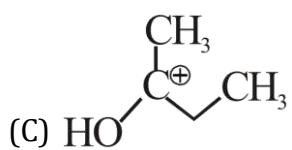
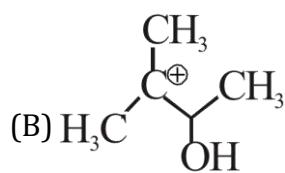
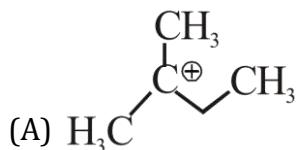


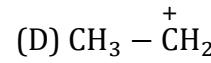
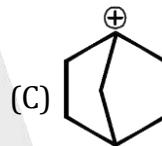
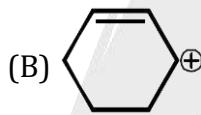
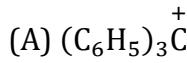
(Organic Chemistry) CARBOCATION AND FREE RADICAL

EXERCISE - I (MAINS ORIENTED)

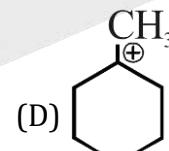
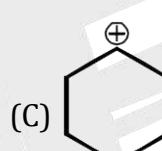
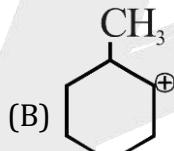
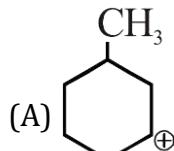
1. Which of the following carbocation is most stable?



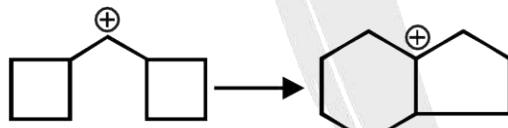
2. Which carbocation is least likely to be formed as an intermediate?



3. Which one of the following carbocation would you expect to rearrange:



4. How many 1, 2-shifts are involved during the course of following reaction:



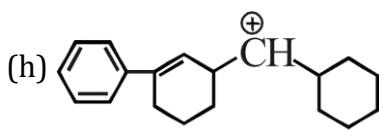
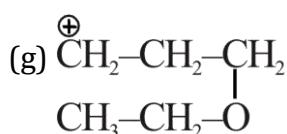
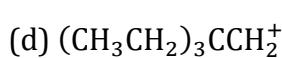
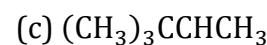
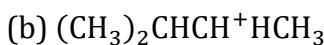
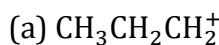
(A) 1

(B) 2

(C) 3

(D) 4

5. How many following carbocation undergo re-arrangement?



(A) 5

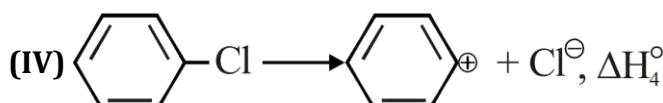
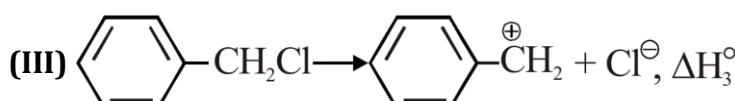
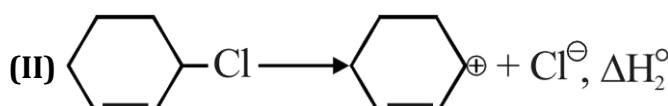
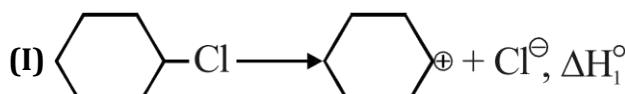
(B) 8

(C) 6

(D) 7

(Organic Chemistry) CARBOCATION AND FREE RADICAL

6. For the reactions



The correct decreasing order of enthalpies of reaction for producing carbocation is

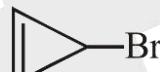
(A) $\Delta H_1^\circ > \Delta H_2^\circ > \Delta H_3^\circ > \Delta H_4^\circ$

(B) $\Delta H_4^\circ > \Delta H_1^\circ > \Delta H_2^\circ > \Delta H_3^\circ$

(C) $\Delta H_3^\circ > \Delta H_2^\circ > \Delta H_1^\circ > \Delta H_4^\circ$

(D) $\Delta H_2^\circ > \Delta H_1^\circ > \Delta H_4^\circ > \Delta H_3^\circ$

7. Which is not the correct statement for given compound :



(I)

(A) I is more soluble than bromocyclopropane

(B) I gives pale yellow ppt. on addition with AgNO_3

(C) I has lower dipole moment than bromocyclopropane

(D) On reaction with AlBr_3 , I will produce aromatic compound having 3 equivalent resonating structures

8. A solution of (-) – 1-chloro-1-phenylethane in toluene racemises slowly in the presence of a small amount of SbCl_5 , due to the formation of :

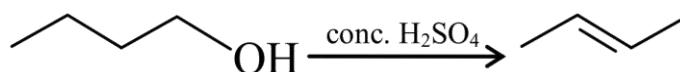
(A) carbanion

(B) carbene

(C) carbocation

(D) free radical

9. How many 1, 2-Shifts are involved during the course of following reaction :



(A) 1

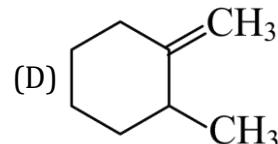
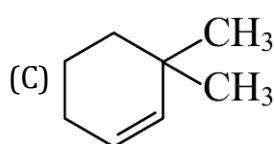
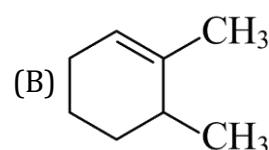
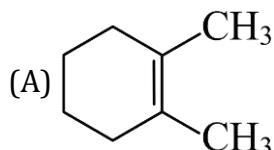
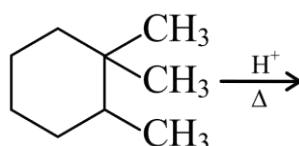
(B) 0

(C) 3

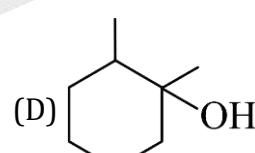
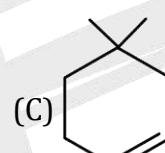
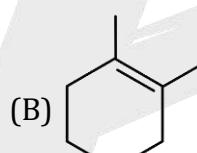
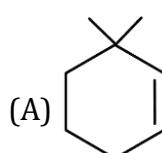
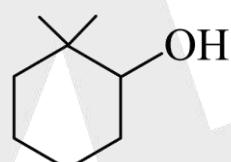
(D) 4

(Organic Chemistry) CARBOCATION AND FREE RADICAL

10. Major product of following reaction is :



11. Major product of following reaction is :



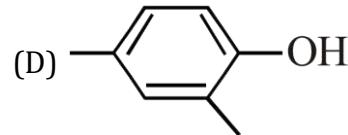
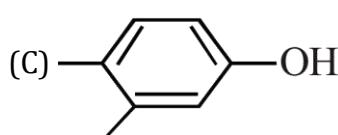
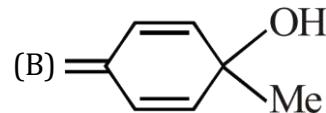
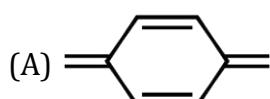
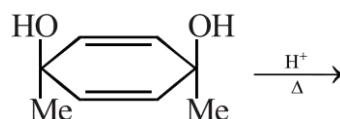
12. Among the given compounds, the correct dehydration order is :



- (A) I < II < III < IV
(C) I < III < IV < II

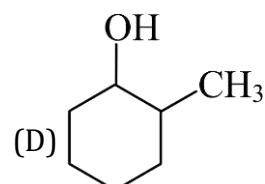
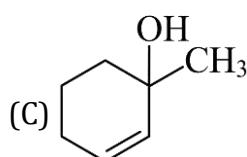
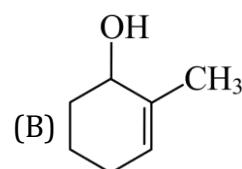
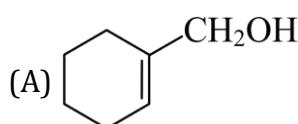
- (B) II < III < IV < I
(D) I < II < III = IV

13. Major product of following reaction is :

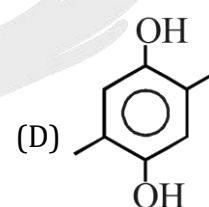
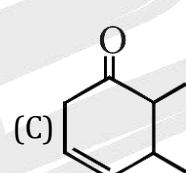
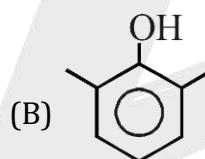
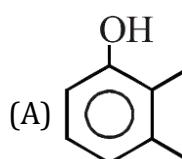


(Organic Chemistry) CARBOCATION AND FREE RADICAL

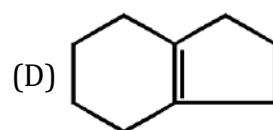
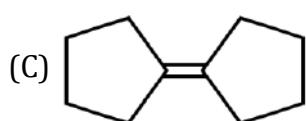
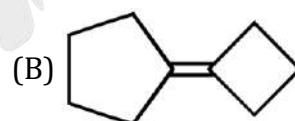
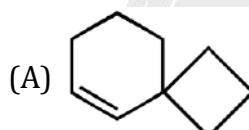
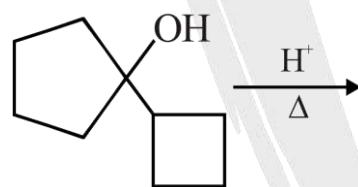
14. Rate of dehydration when given compounds are treated with conc. H_2SO_4 :



15. One of the major product of following reaction is :

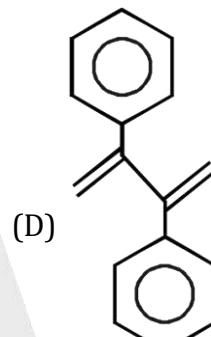
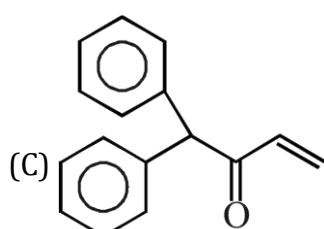
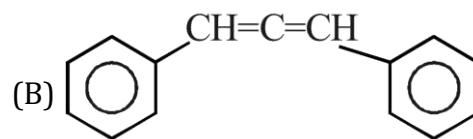
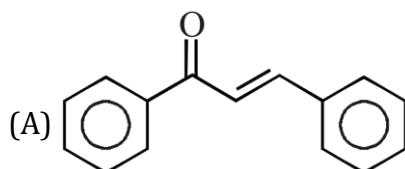
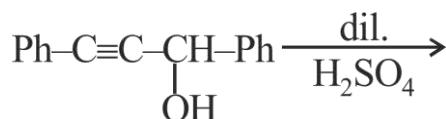


16. Major product of following reaction is :

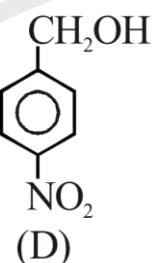
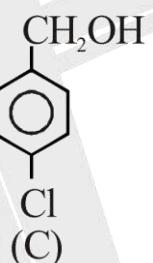


(Organic Chemistry) CARBOCATION AND FREE RADICAL

17. Major product of following reaction is :



18. What is the decreasing order of rate of reaction with HBr for the following benzyl alcohol and its derivative:



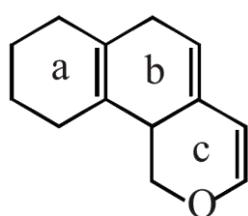
- (A) A > C > D > B
(C) D > C > B > A

- (B) A > B > D > C
(D) A > B > C > D

19. Which will dehydrate at fastest rate by H_3PO_4 :

- | | |
|-------------------------|-------------------------|
| (A) 2-methyl butan-2-ol | (B) 3-methyl butan-2-ol |
| (C) Butan-1-ol | (D) 2-methyl butan-1-ol |

20.

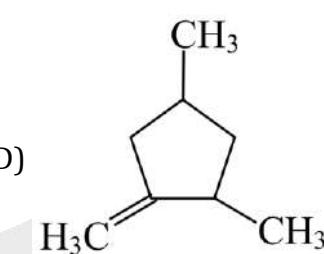
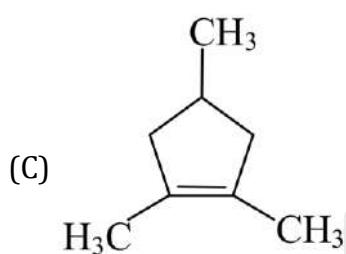
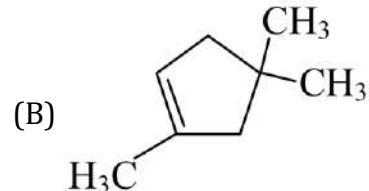
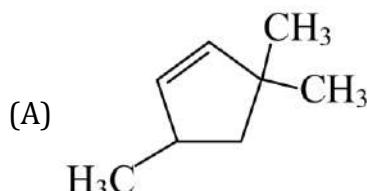
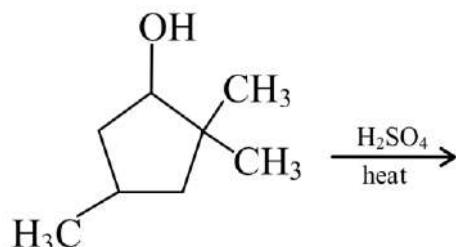


The double bond which is most reactive towards electrophile :

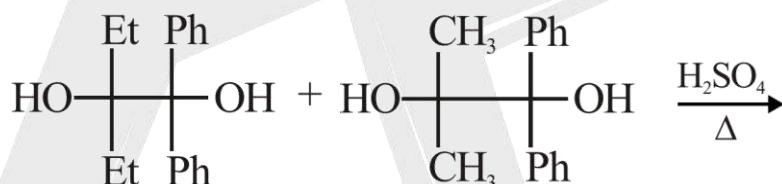
- (A) a (B) b (C) c (D) None

(Organic Chemistry) CARBOCATION AND FREE RADICAL

21. The major product formed in the following reaction is :



22. How many products are obtained in the given reaction :



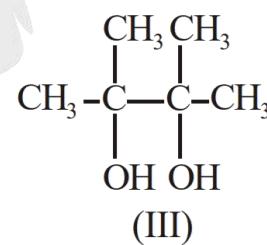
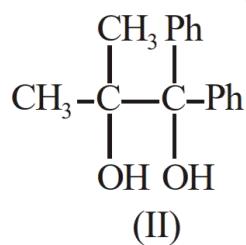
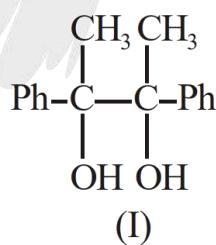
(A) 1

(B) 2

(C) 3

(D) 4

23. Compare rate of reaction towards pinacol to pinacolone rearrangement.



(A) II > III > I

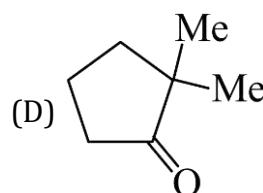
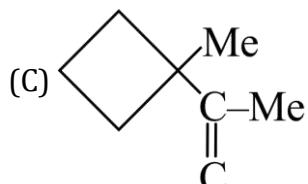
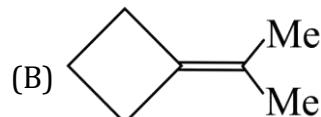
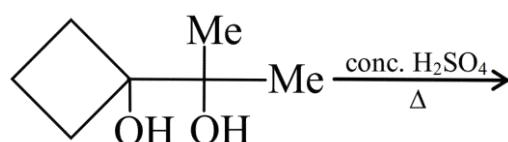
(B) III > II > I

(C) II > I > III

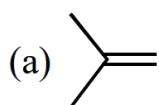
(D) I > II > III

(Organic Chemistry) CARBOCATION AND FREE RADICAL

24. Major product of following reaction is :



25. What is the order of reactivity with HBr :



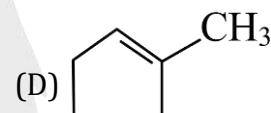
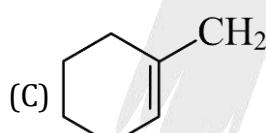
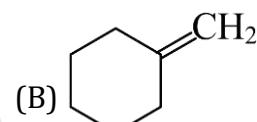
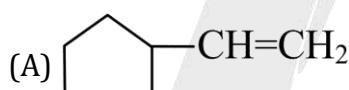
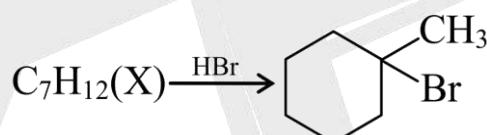
(A) a > b > c

(B) b > a > c

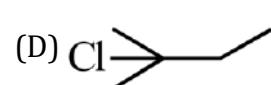
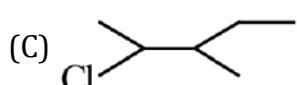
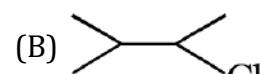
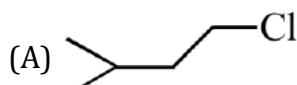
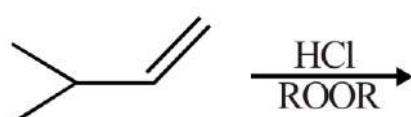
(C) c > b > a

(D) b > c > a

26. In the given reaction, (X) can not be :

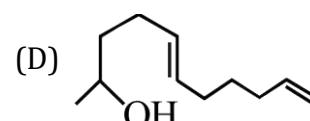
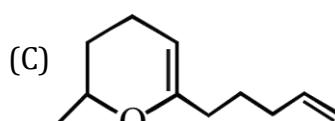
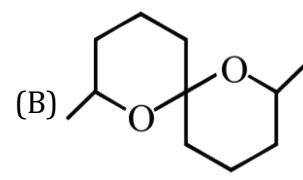
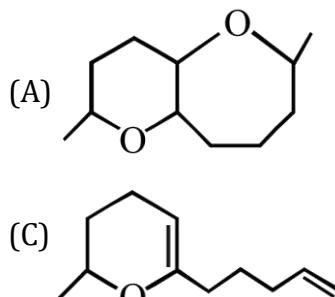
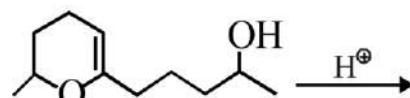


27. Major product of the reaction is :

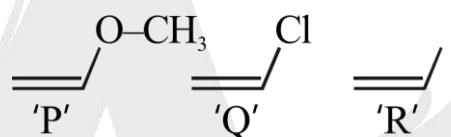


(Organic Chemistry) CARBOCATION AND FREE RADICAL

28. Major product of following reaction is :



29. Arrange the following compounds in decreasing order of electrophilic addition :



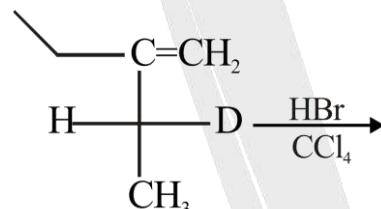
(A) P' > Q' > R'

(B) P' > R' > Q'

(C) R' > P' > Q'

(D) R' > Q' > P'

30. Major product mixture (without rearrangement of carbocation) of following reaction is :



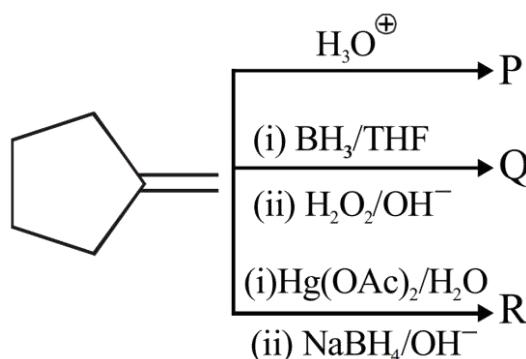
(A) Racemic mixture

(B) Optically inactive

(C) Mixture of diastereomers

(D) Meso product

31. Correct statement regarding products P, Q & R is :



(A) Product P & R are same

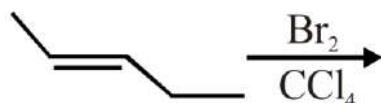
(B) Product Q & R are same

(C) P & Q are functional isomers

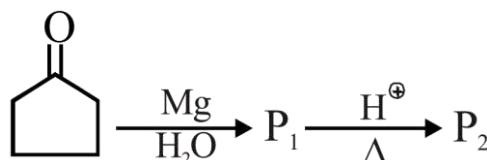
(D) Product P, Q & R all are different

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32. Select the incorrect statement about the product mixture in the following reaction :

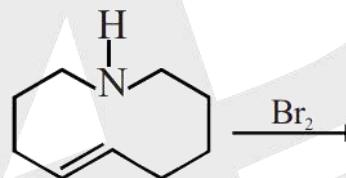


33. Which of the following is not correct about P_2 :



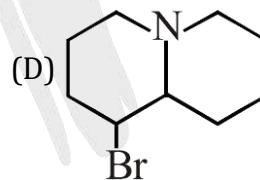
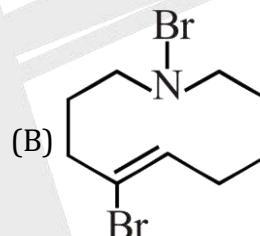
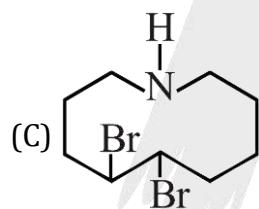
- (A) It is a spiro compound (B) It is a Ketone
(C) It can show tautomerism (D) Its double bond equivalent is 4

34. Major product of following reaction is :

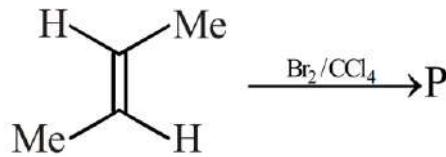


- (A)  A bicyclic compound consisting of a four-membered ring fused to a six-membered ring. The four-membered ring has two methyl groups and two hydrogen atoms. The six-membered ring has two bromine atoms at the 1 and 2 positions.

(B)  A six-membered ring with a double bond between the second and third carbons. It has two bromine atoms at the 1 and 2 positions.



35. Select incorrect statements about the product (P) of the reaction :



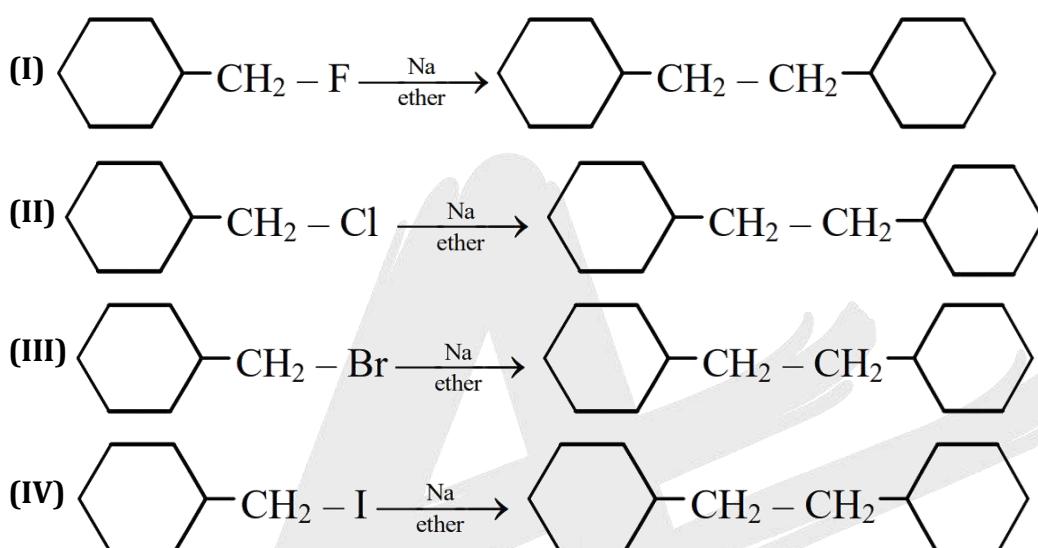
- (A) P is optically inactive due to internal compensation
 - (B) P is optically inactive due to the presence of plane of symmetry in the molecule
 - (C) The structure of P can have three optical isomers possible.
 - (D) P can have four possible optical isomers.

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36. Which of the following will produce vicinal dibromide on reaction with Conc. HBr ?
 (A) Alkyne (B) Allene (C) Vinyl bromide (D) Allyl bromide

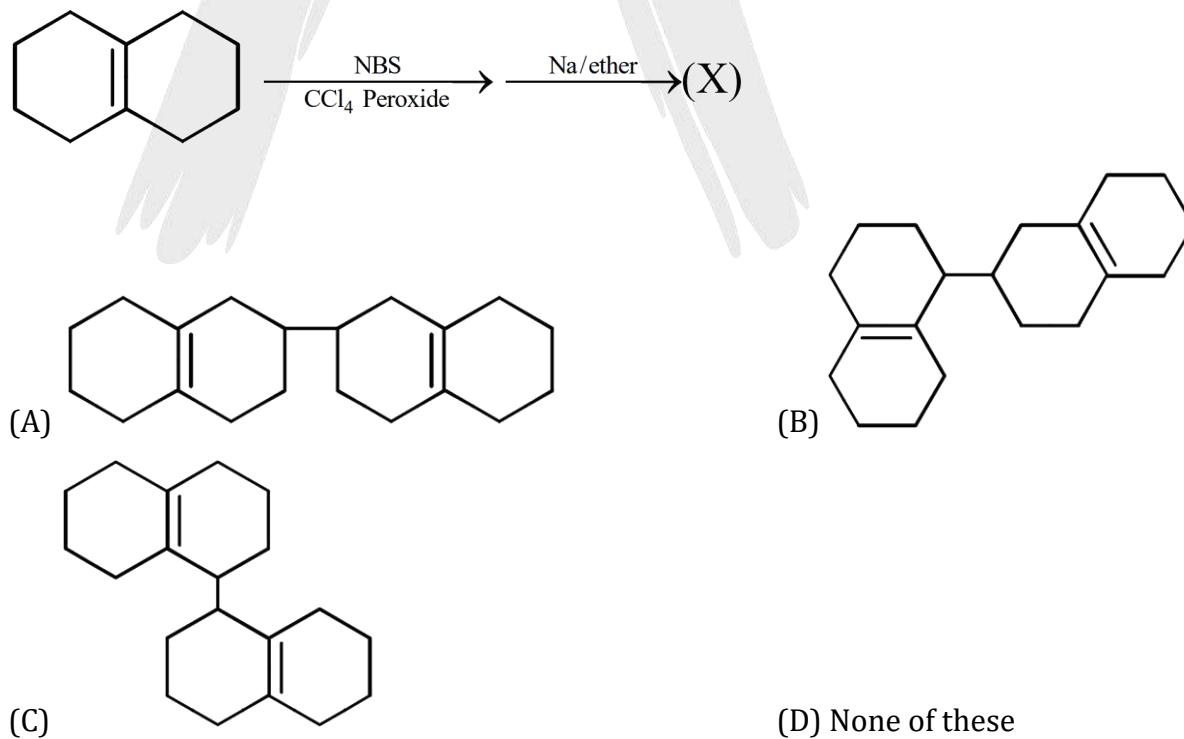
37. Consider the following groups, the order of leaving group nature is :
 (I) $-OAc$ (II) $-OMe$ (III) $-OSO_2Me$ (IV) $-OSO_2CF_3$
 (A) I > II > III > IV (B) IV > III > I > II
 (C) III > II > I > IV (D) II > III > IV > I

38. The correct order of rate of following Wurtz reactions :



- (A) I > II > III > IV (B) II > I > III > IV
 (C) IV > III > II > I (D) In all rate of Wurtz reaction is same

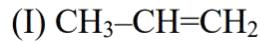
39. Major product of following reaction is :



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40. Find out the correct order of rate of reaction towards free radical allylic substitution :



(A) I > II > III

(B) II > I > III

(C) III > II > I

(D) III > I > II



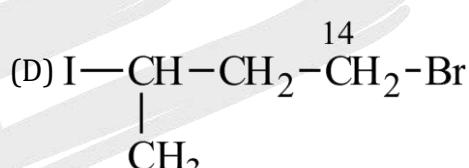
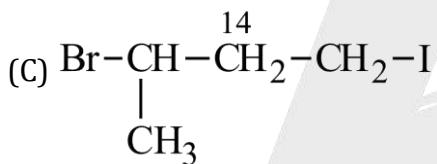
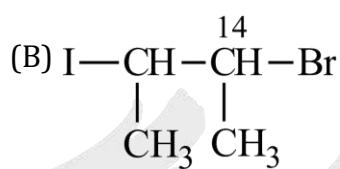
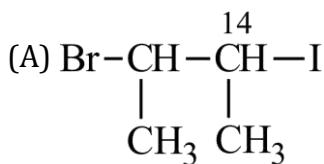
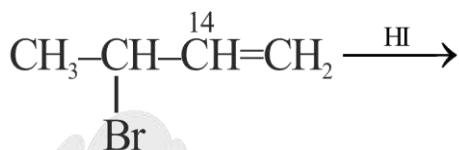
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EXERCISE - II-(A)

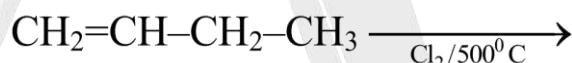
1. Among the isomeric alkanes of molecular formula "C₅H₁₂", which of the following yields four structures of monochlorides on photochemical chlorination.



2. Products which can be obtained during the reaction in good yield:

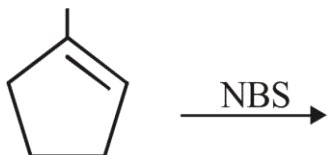


3. Correct statement(s) for the monochlorinated products of following reaction.



- (A) Four different products are formed
 (B) Two optically active products are formed
 (C) The optically active compound formed here can also be made by the reaction of HCl
 (D) The reaction path is free radical substitution.

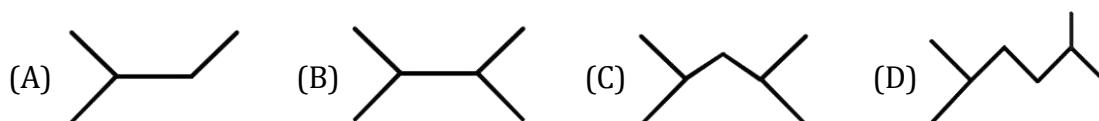
4. In the given reaction, find out the correct statement(s)



- (A) It gives total 9 allylic brominated products
 (B) 6 fractions are obtained on fractional distillation of product mixture
 (C) Substrate has 7 allylic hydrogens
 (D) NBS is a brominating agent for allylic positions

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5. Which of the following can be produced by Wurtz reaction in good yield:



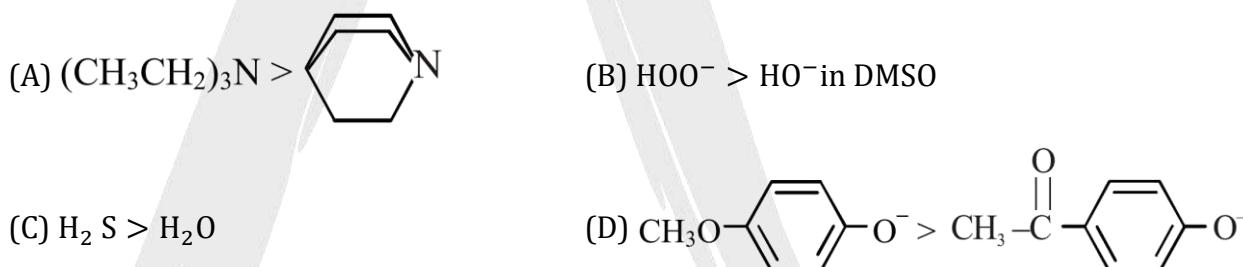
6. Products formed when HCl adds to 2,4-hexadiene is :

- (A) 4-chloro-2-hexene
- (B) 2-chloro-3-hexene
- (C) 2-chloro-4-hexene
- (D) 1-chloro-2-hexene

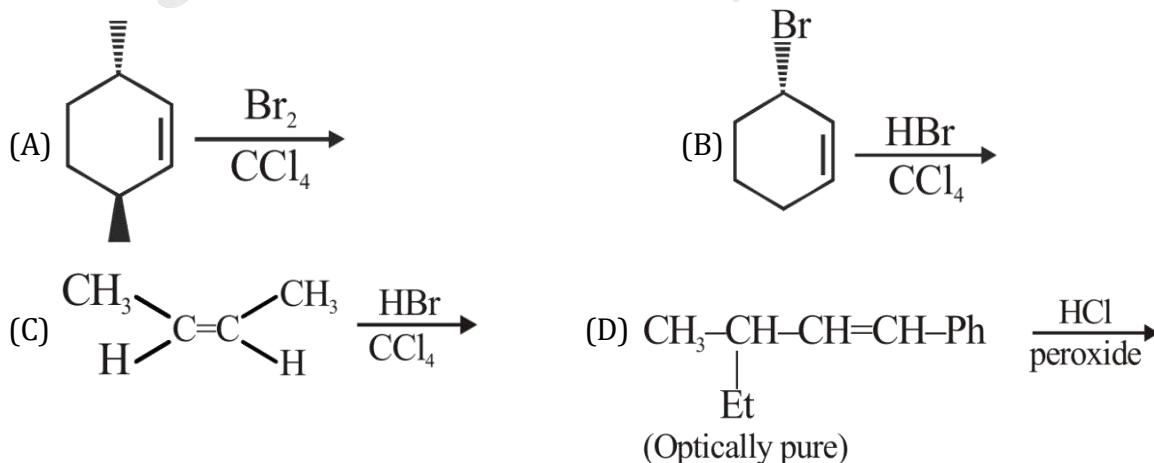
7. Correct statements among the following is/are :

- (A) Dihaloalkanes having the same type of halogen atoms on same atom are named as alkylidene dihalides
- (B) Dihaloalkanes having the same type of halogen atoms on adjacent atoms are named as alkylene dihalides
- (C) In common name system gem-dihalides are named as alkylidene halide
- (D) In common name system vic-dihalides are named as alkylene halide

8. Which of the following is(are) correct order of nucleophilicity?

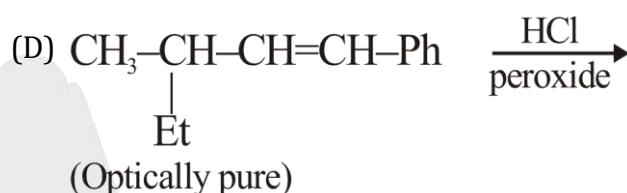
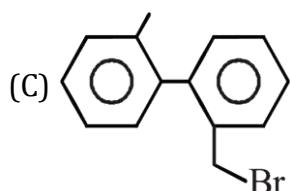
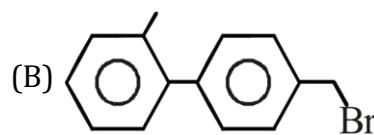
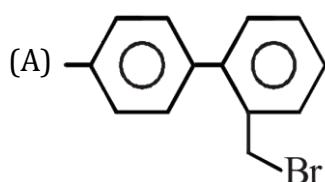
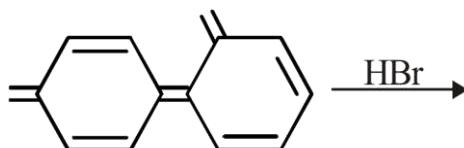


9. Which of following reaction products are diastereomer of each other:

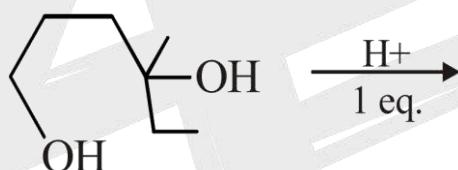


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10. Which of following reaction products are diastereomer of each other:

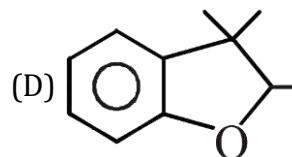
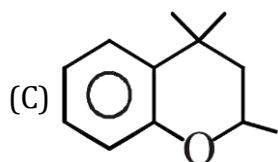
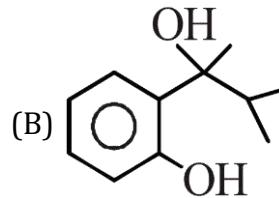
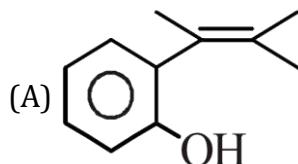
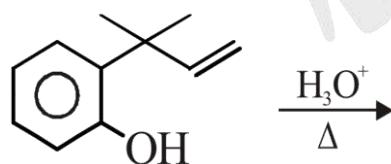


11. Correct statements for given reaction is (are):



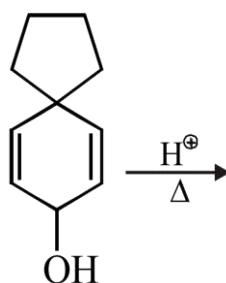
- (A) Product mixture is resolvable
- (B) Product can be separated by fractional distillation of mixture
- (C) Two products possible & both are optically active
- (D) Products are diastereomer

12. Which of the following can be formed during this reaction?



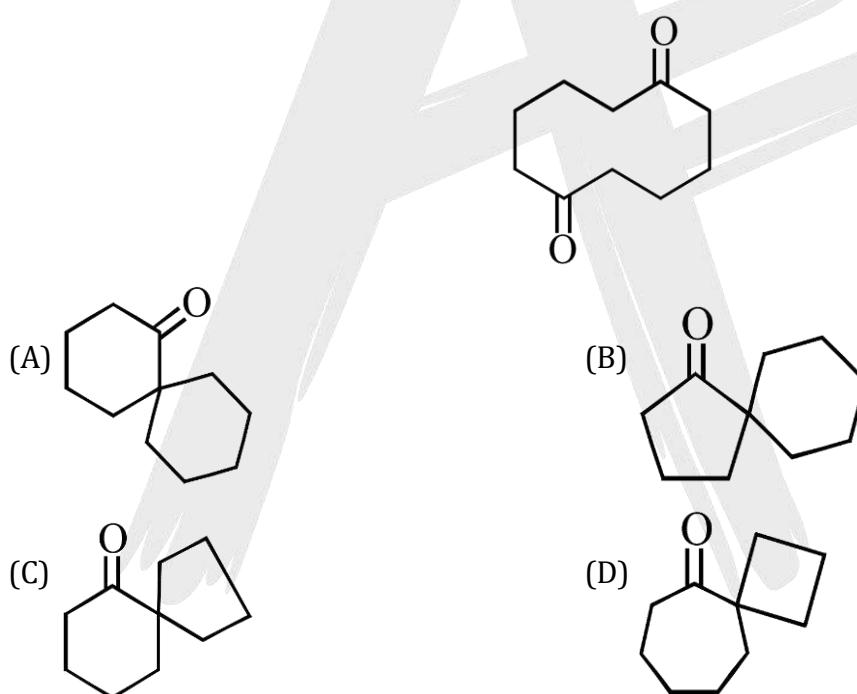
(Organic Chemistry) CARBOCATION AND FREE RADICAL

13. Major product of following reaction is :



- (A)
- (B)
- (C)
- (D)

14. Major product (Q) of following reaction is :

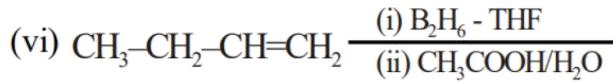
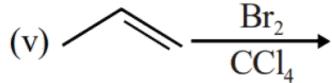
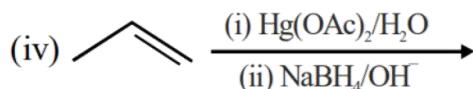
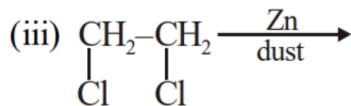
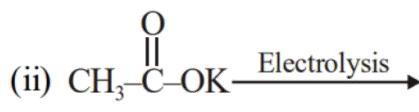
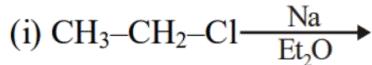


15. Select True statement(s) :

- (A) Cyclopropane decolorizes bromine water
- (B) In general, bromination is more selective than chlorination.
- (C) The 2,4,6-tri-tert, butylphenoxy radical is resistant to dimerization.
- (D) The radical-catalysed chlorination, $\text{ArCH}_3 \rightarrow \text{ArCH}_2\text{Cl}$, occurs faster when Ar = phenyl than when Ar = p-nitrophenyl.

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16. Number of following reactions which produces hydrocarbon as major product ?



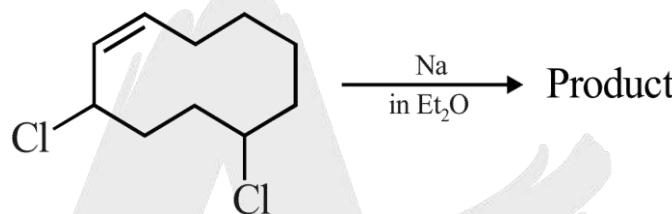
(A) 2

(B) 4

(C) 5

(D) 6

17. Correct statement regarding major product is/are :



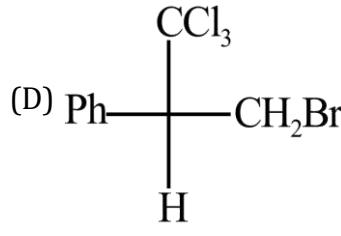
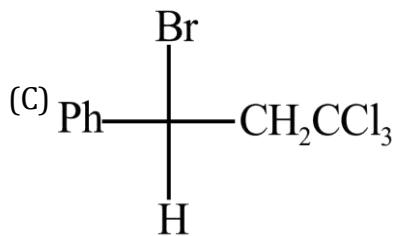
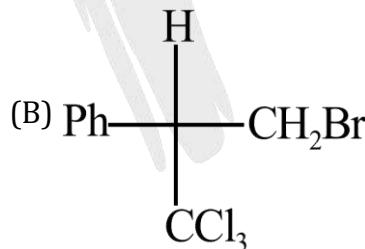
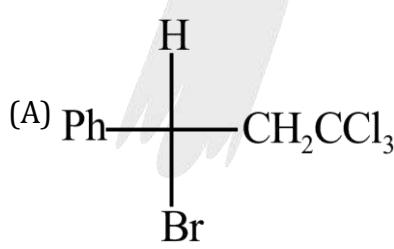
(A) odd no. of double bond equivalent in product

(B) product is bicyclic compound

(C) product can show geometrical isomerism

(D) reaction involve carbocation as intermediate

18. Major product of following reaction is :



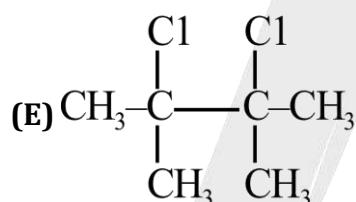
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EXERCISE # II-B

1. Statement-1: HBr shows antimarkownikoff's addition on propene but not HCl.
 Statement-2: H – Br is stronger acid than H – Cl.
 (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement 1 .
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.
2. Each of the compounds in column A is subjected to further chlorination. Match the following for them:

Column-A

- (A) $\text{CHCl}_2 - \text{CH}_2 - \text{CH}_3$
 (B) $\text{CH}_2\text{Cl} - \text{CHCl} - \text{CH}_3$
 (C) $\text{CH}_2\text{Cl} - \text{CH}_2 - \text{CH}_2 - \text{Cl}$
 (D) $\text{CH}_3 - \text{CCl}_2 - \text{CH}_3$

**Column-B**

- (P) Optically active original compound
 (Q) Only one trichloro product
 (R) Three trichloro product.
 (S) Four trichloro product
 (T) Atleast one of the trichloro product is optically active
 (U) Two trichloro products.

3. **Column-I (Intermediate)**

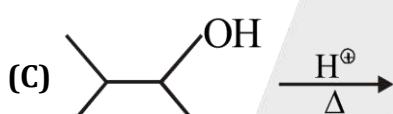
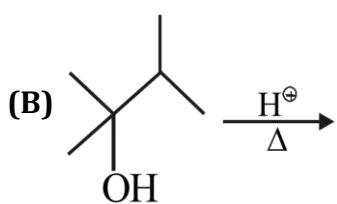
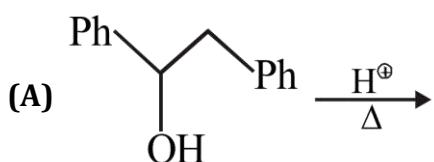
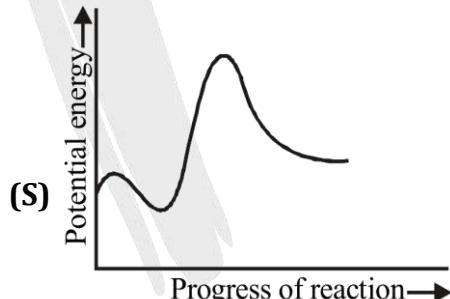
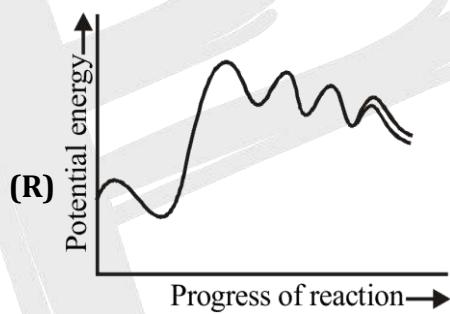
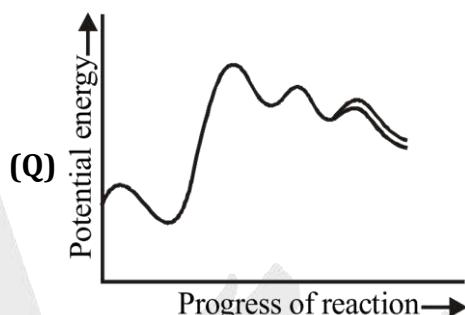
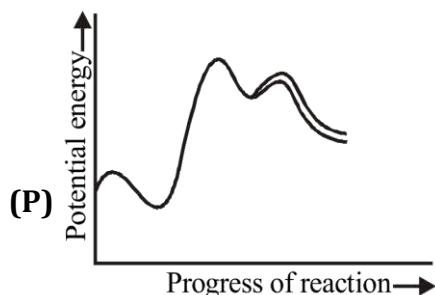
- (A) Carbocation
 (B) Carbanion
 (C) Free radical
 (D) Octet complete in one of the intermediate sodalime

Column-II

- (P) Kolbey Electrolysis
 (Q) Wurtz reaction
 (R) Dehydration of alcohol
 (S) Monocarboxylic acid with

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4. Match the Column.

Column-I (Reaction)**Column-II (Potential Energy Curve)**

5. RCl is treated with Li in ether to form R – Li, R – Li reacts with water to form isopentane. R – Cl also reacts with sodium to form 2, 7-dimethyloctane. What is the structure of R – Cl.
6. A chloroderivative ' X ' on reduction gave a hydrocarbon with five carbon atoms in the molecule. When X is dissolved in ether and treated with sodium, 2, 2, 5, 5-tetramethyl hexane is obtained. What is compound X.

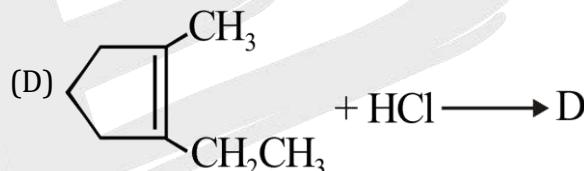
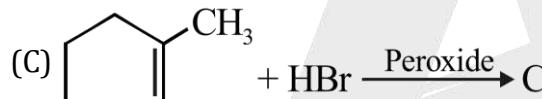
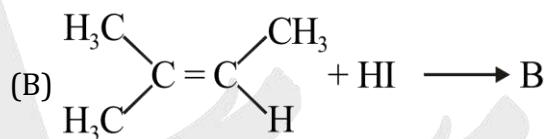
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7. With the help of following data show HBr exhibits the peroxide effect.

	$\Delta H_1^0/\text{kJmol}^{-1}$	$\Delta H_2^0/\text{kJmol}^{-1}$
H – X	$\dot{X} + \text{CH}_2 = \text{CH}_2 \rightarrow \text{XCH}_2 - \dot{\text{C}}\text{H}_2$	$\text{XCH}_2 - \dot{\text{C}}\text{H}_2 + \text{H} - \text{X} \rightarrow \text{XCH}_2\text{CH}_3 + \dot{X}$
	↓	
HCl	-67	+12.6
HBr	-25.1	-50.2
HI	+46	-117.1

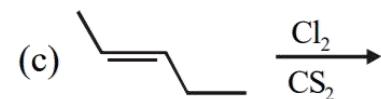
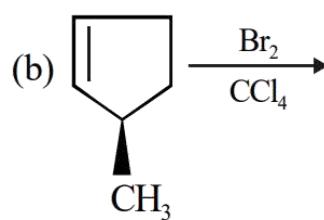
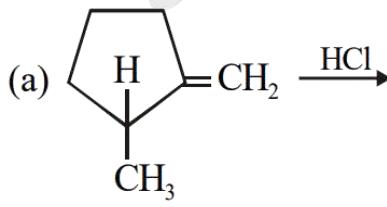
8. Write all the monochlorinated products (including stereo) of isohexane.

9. What are the products of the following reactions?



10. It required 0.7 g of a hydrocarbon (A) to react completely with Br₂ (2.0 g) and form a non resolvable product. On treatment of (A) with HBr it yielded monobromo alkane (B). The same compound (B) was obtained when (A) was treated with HBr in presence of peroxide. Write down the structure formula of (A) and (B) and explain the reactions involved.

11. Complete following reaction :



12. CH ≡ C – CH₂ – CH = CH₂, adds up HBr to give CH ≡ C – CH₂ – CHBr – CH₃ while CH ≡ C – CH = CH₂ adds up HBr to give CH₂ = C. Br. CH = CH₂.

(Organic Chemistry) CARBOCATION AND FREE RADICAL

13. In study of chlorination of propane four products (A, B, C, D) of molecular formula $C_3H_6Cl_2$ were obtained. On further chlorination of the above products A gave one trichloro product, B gave two whereas C and D gave three each. When optically active C was chlorinated one of trichloro propanes was optically active and remaining two were optically inactive. Identify the structures of A, B, C and D, and explain formation of products.



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EXERCISE # JEE-MAINS

1. The reaction of propene with HOCl(Cl₂ + H₂O) proceeds through the intermediate:

[JEE MAIN 2016]

2. 3-Methyl-pent-2-ene on reaction with HBr in presence of peroxide forms an addition product. The number of possible stereoisomers for the product is :- [JEE MAIN 2017]

(A) Six (B) Zero (C) Two (D) Four

3. The increasing order of nucleophilicity of the following nucleophiles is:

(A) $\text{CH}_3 - \text{CHCl} - \text{CH}_2^+$ (B) $\text{CH}_3 - \text{CH}^+ - \text{CH}_2 - \text{OH}$
 (C) $\text{CH}_3 - \text{CH}^+ - \text{CH}_2 - \text{Cl}$ (D) $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_2^+$

[JEE MAIN-2019]

4. The major product of the following addition reaction is: [JEE MAIN-2019]

(a) $\text{CH}_3\text{CO}_2^\ominus$ (b) H_2O (c) $\text{CH}_3\text{SO}_3^\ominus$ (d) OH^\ominus

(A) (b) < (c) < (d) < (a)
 (B) (b) < (c) < (a) < (d)
 (C) (a) < (d) < (c) < (b)
 (D) (d) < (a) < (c) < (b)

(A) $\begin{array}{c} \text{CH}_3 - \underset{\text{Cl}}{\text{CH}} - \underset{\text{OH}}{\text{CH}_2} \end{array}$
 (B) $\begin{array}{c} \text{H}_3\text{C} - \underset{\text{OH}}{\text{CH}} - \underset{\text{Cl}}{\text{CH}_2} \end{array}$

(C) $\begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{H}_3\text{C} \quad \text{CH}_3 \end{array}$
 (D) $\begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{H}_3\text{C} - \text{C} \end{array}$

5. An 'Assertion' and a 'Reason' are given below. Choose the correct answer from the following options: **[JEE MAIN-2019]**

Assertion (A): Vinyl halides do not undergo nucleophilic substitution easily.

Reason (R): Even though the intermediate carbocation is stabilized by loosely held π electrons, the cleavage is difficult because of strong bonding.

- (A) (A) is a correct statement but (R) is a wrong statement.
 - (B) Both (A) and (R) are correct statements but (R) is not the correct explanations of (A).
 - (C) Both (A) and (R) are wrong statements
 - (D) Both (A) and (r) are correct statements and (R) is the correct explanation of (A).

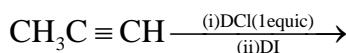
6. Which one of the following alkenes when treated with HCl yields majorly an anti Markovnikov product? [JEE MAIN-2019]

[JEE MAIN-2019]

(Organic Chemistry) CARBOCATION AND FREE RADICAL

7. The major product of the following reaction is:

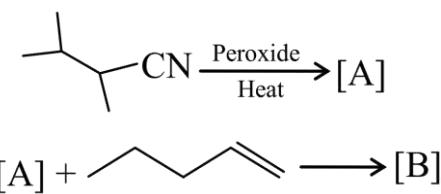
[JEE MAIN-2019]



- (A) $\text{CH}_3\text{CD(I)CHD(Cl)}$
 (B) $\text{CH}_3\text{CD(Cl)CHD(I)}$
 (C) $\text{CH}_3\text{CD}_2\text{CH(Cl)(I)}$
 (D) $\text{CH}_3\text{C(I)(Cl)CHD}_2$

8. The major products A and B in the following reactions are :

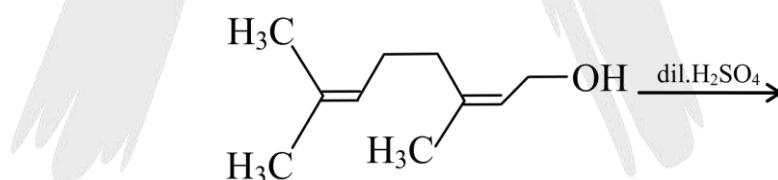
[JEE MAIN-2020]



- (A) A = and B =
 (B) A = and B =
 (C) A = and B =
 (D) A = and B =

9. The major product of the following reaction is :

[JEE MAIN-2020]

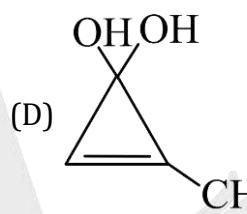
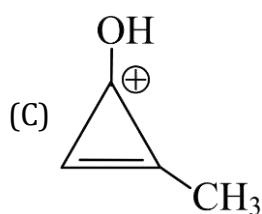
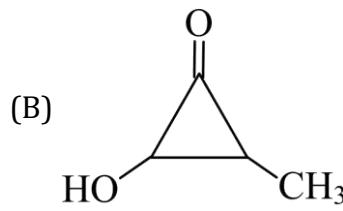
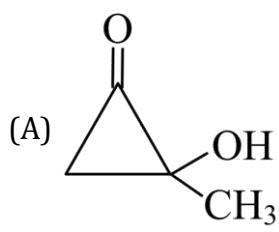
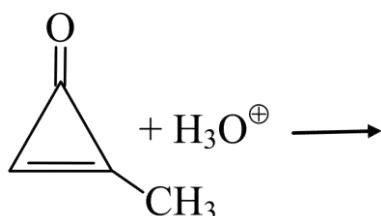


- (A)
 (B)
 (C)
 (D)

(Organic Chemistry) CARBOCATION AND FREE RADICAL

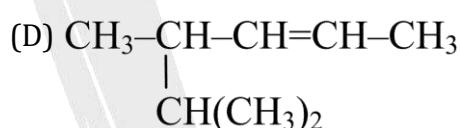
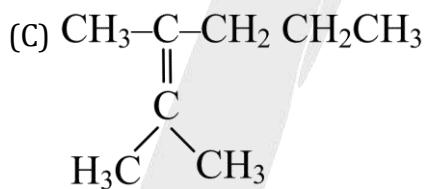
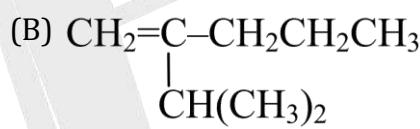
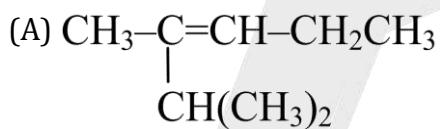
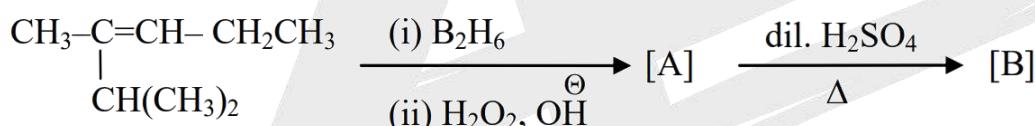
10. The major product in the following reaction is :

[JEE MAIN-2020]



11. The major product [B] in the following sequence of reactions is :

[JEE MAIN-2020]



12. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Treatment of bromine water with propene yields 1-bromopropan-2-ol.

Reason (R) : Attack of water on bromonium ion follows Markovnikov rule and results in 1-bromopropan-2-ol.

In the light of the above statements, choose the most appropriate answer from the options given below :

[JEE MAIN-2021]

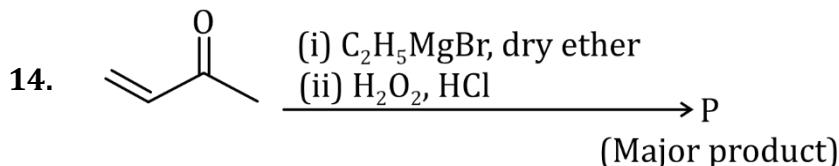
- (A) Both (A) and (R) are true but (R) is NOT the correct explanation of (A).
- (B) (A) is false but (R) is true.
- (C) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (D) (A) is true but (R) is false.

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13. In the given reaction 3 -Bromo-2, 2 -dimethyl butane $\xrightarrow{\text{C}_2\text{H}_3\text{OH}}$ 'A' (Major Product) Product A is:

[JEE MAIN-2021]

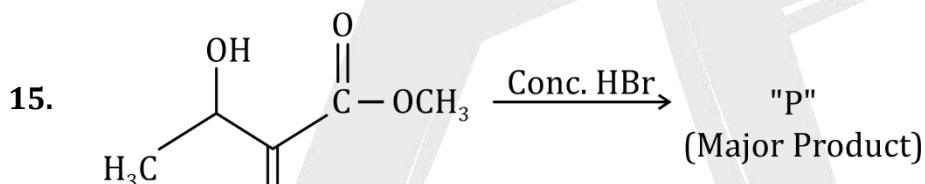
- (A) 2-Ethoxy-3, 3-dimethyl butane
- (B) 1-Ethoxy-3, 3-dimethyl butane
- (C) 2 -Ethoxy-2, 3 -dimethyl butane
- (D) 2-Hydroxy-3, 3-dimethyl butane



Consider the above reaction, the major product 'P' is:

[JEE MAIN-2021]

- (A)
- (B)
- (C)
- (D)

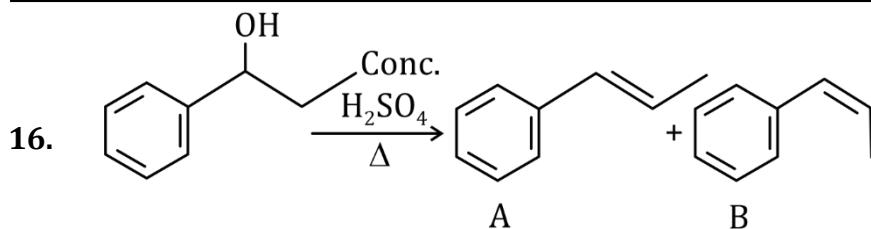


Consider the above reaction, the major product "P" formed is :-

[JEE MAIN-2021]

- (A)
- (B)
- (C)
- (D)

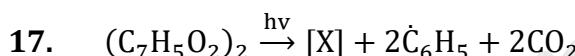
(Organic Chemistry) CARBOCATION AND FREE RADICAL



consider the above reaction, and choose the correct statement:

[JEE MAIN-2021]

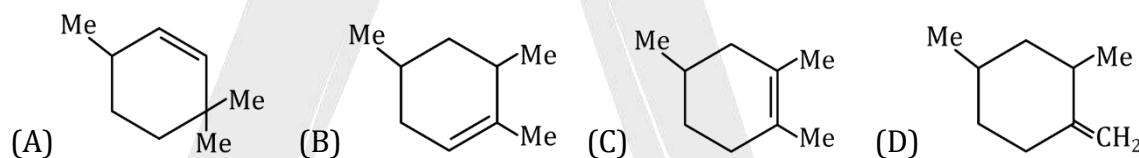
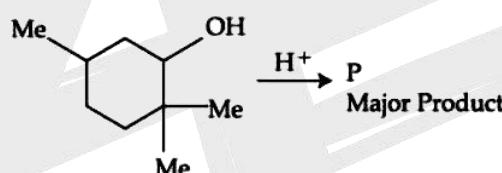
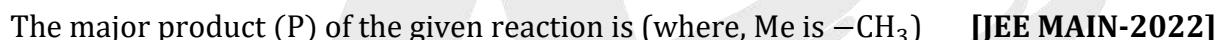
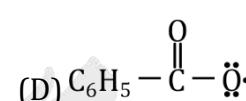
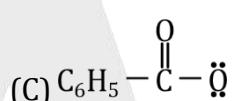
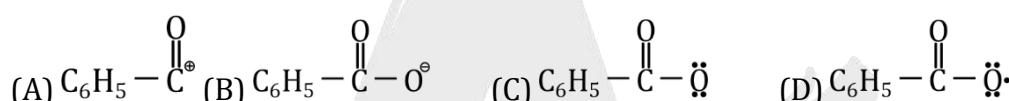
- (A) The reaction is not possible in acidic medium
 - (B) Both compounds A and B are formed equally
 - (C) Compound A will be the major product
 - (D) Compound B will be the major product



Consider the above reaction and identify the intermediate 'X'

[JEE MAIN-2022]

- 18.** The major product (P) of the given reaction is (where, Me is $-\text{CH}_3$) [JEE MAIN-2022]



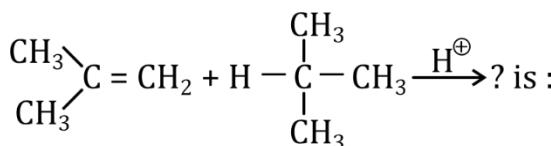
19. The major product 'A' of the following given reaction has ___ sp² hybridized carbon atoms.
2,7 - Dimethyl1 - 2,6-octadiene



[JEE MAIN-2022]

- 20.** The products formed in the following reaction.

[JEE MAIN-2022]



- $$(A) \begin{array}{c} \text{CH}_3 \\ | \\ \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH} \\ | \\ \text{CH}_3 \end{array}$$

- $$(B) \quad \begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3-\text{C}-\text{CH}_2-\text{C}-\text{CH}_3 \\ | \\ \text{H} \end{array}$$

- $$(C) \text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \underset{\text{CH}_3}{\text{CH}} - \underset{\text{CH}_3}{\text{CH}} \begin{cases} \text{CH}_3 \\ \text{CH}_3 \end{cases}$$

- $$(D) \begin{array}{c} & \text{CH}_3 & \text{CH}_3 \\ & | & | \\ \text{CH}_3 & - \text{C} & - \text{C} & - \text{CH}_3 \\ & | & | \\ & \text{CH}_3 & \text{CH}_3 \end{array}$$

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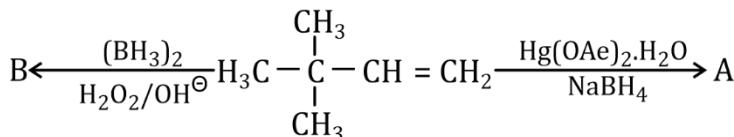
- 21.** Arrange the following in increasing order of reactivity towards nitration [JEE MAIN-2022]

A. p-xylene B. bromobenzene C. mesitylene D. nitrobenzene E. benzene

Choose the correct answer from the options given below

- (A) $C < D < E < A < B$ (B) $D < B < E < A < C$
(C) $D < C < E < A < B$ (D) $C < D < E < B < A$

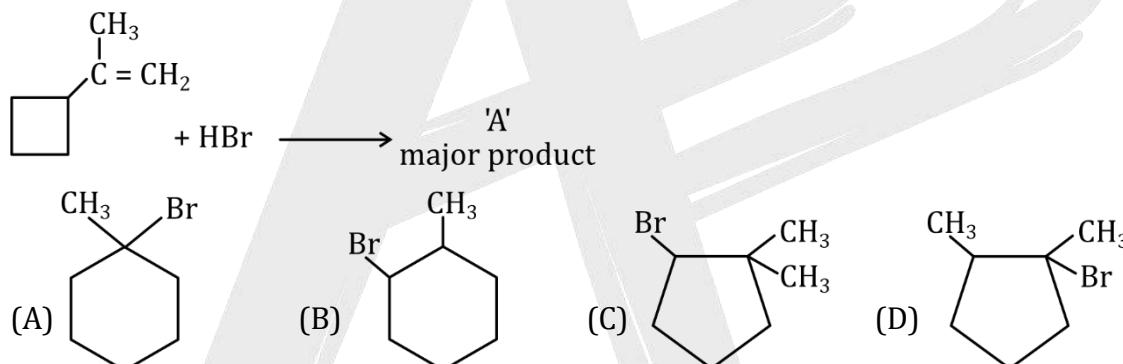
- 22.** Choose the correct option for the following reactions. [JEE MAIN-2022]



- (A) 'A' and 'B' are both Markovnikov addition products.
 - (B) 'A' is Markovnikov product and 'B' is antiMarkovnikov product.
 - (C) 'A' and 'B' are both anti-Markovnikov products.
 - (D) 'B' is Markovnikov and 'A' is antiMarkovnikov product.

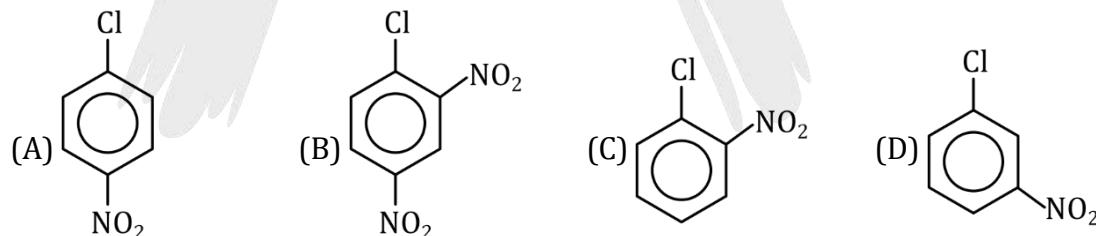
- 23.** In the following given reaction 'A' is

[JEE MAIN-2023]



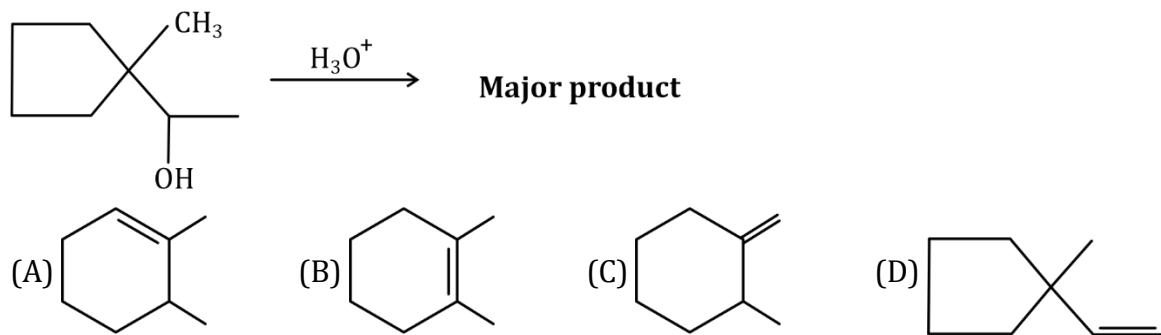
- 24.** The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with OH^- is **[JEE MAIN-2023]**

[JEE MAIN-2023]



- 25.** Find out the major product for the following reaction.

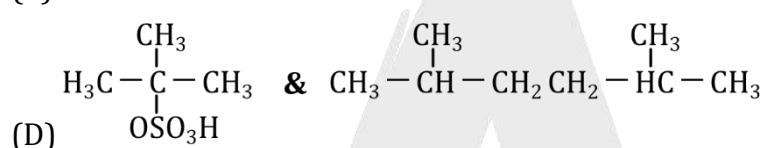
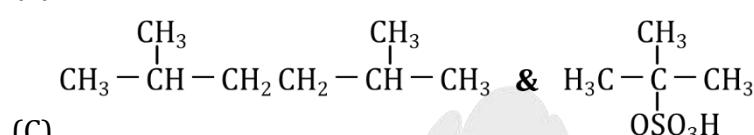
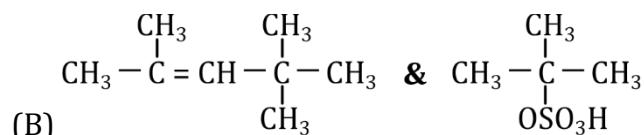
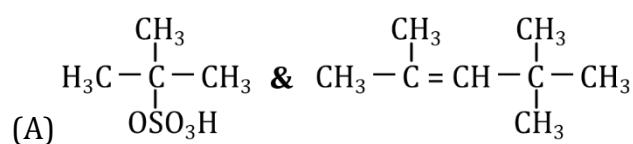
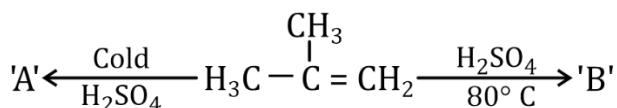
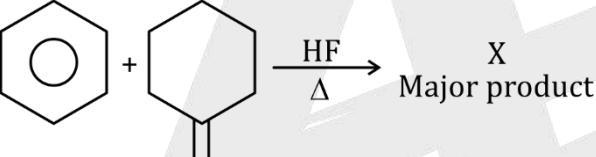
[JEE MAIN-2023]



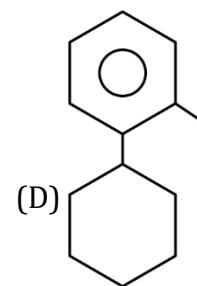
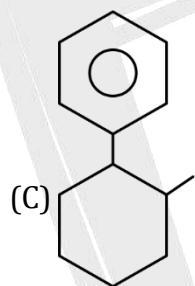
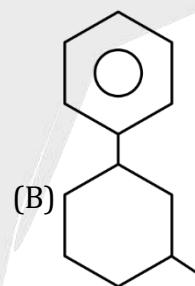
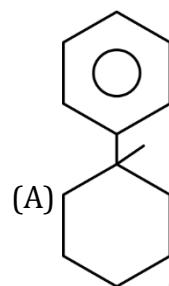
(Organic Chemistry) CARBOCATION AND FREE RADICAL

26. The major products 'A' and 'B', respectively, are

[JEE MAIN-2023]

27. 'X' is : 

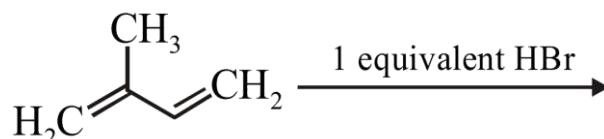
[JEE MAIN-2023]



(Organic Chemistry) CARBOCATION AND FREE RADICAL

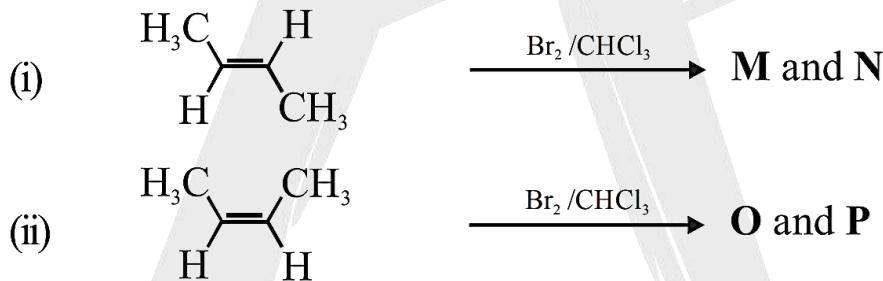
EXERCISE – JEE -ADVANCE (OBJECTIVE)

1. Benzyl chloride ($C_6H_5CH_2Cl$) can be prepared from toluene by chlorination with: [IIT 1998]
 (A) SO_2Cl_2 (B) $SOCl_2$ (C) $Cl_2, (hv)$ (D) $NaOCl$
2. Which of the following has the highest nucleophilicity? [IIT 2000]
 (A) F^- (B) OH^- (C) CH_3^- (D) NH_2^-
3. In the following reaction, the major product is [IIT 2015]



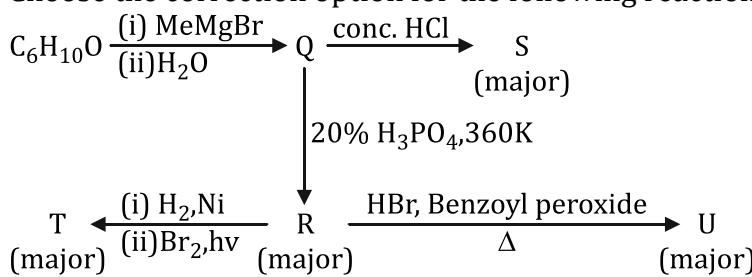
- (A) $CH_2=CH-CH_2-CH_3$
 (B) $H_3C-CH(Br)-CH_2-CH_3$
 (C) $H_2C=CH-CH_2-CH_2-Br$
 (D) $H_3C-CH_2-CH(Br)-CH_2-CH_3$

4. The correct statement(s) for the following addition reactions is (are) [IIT 2017]

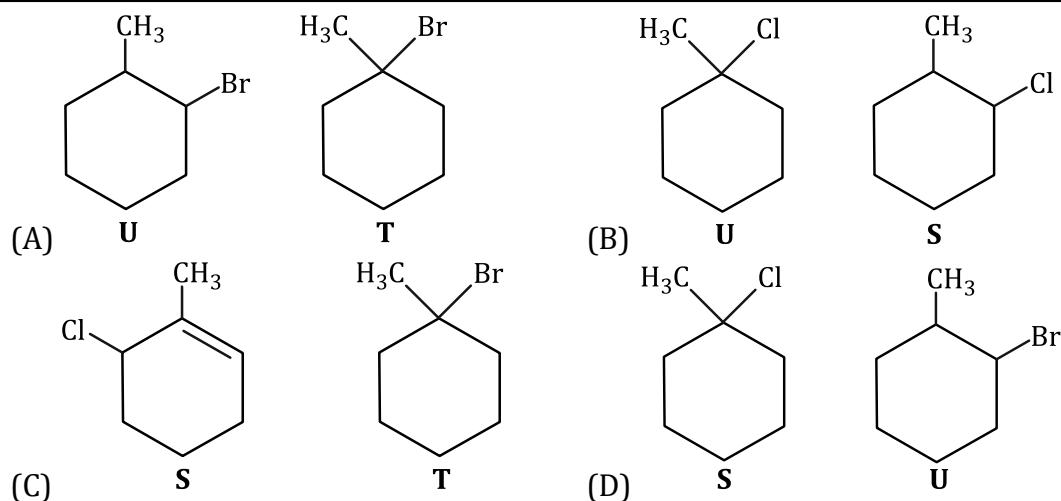


- (A) (M and O) and (N and P) are two pairs of diastereomers
 (B) Bromination proceeds through trans-addition in both the reactions
 (C) O and P are identical molecules
 (D) (M and O) and (N and P) are two pairs of enantiomers

5. Choose the correct option for the following reaction [IIT 2019]

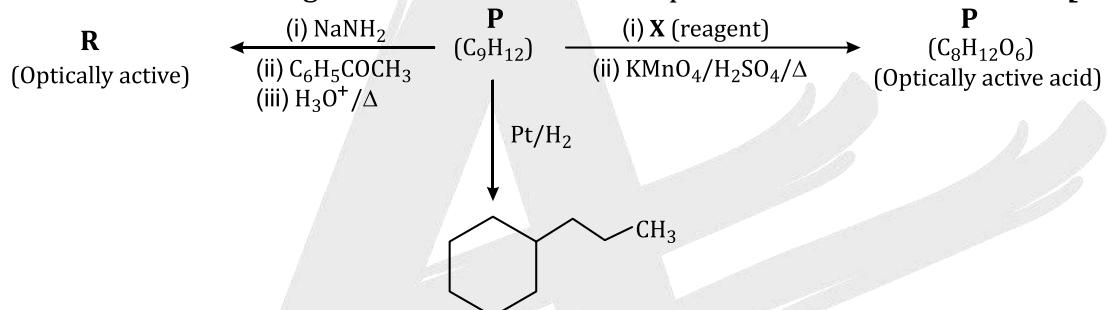


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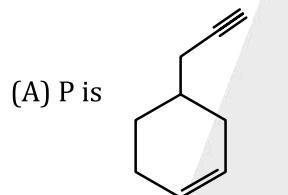


6. Consider the following transformations of a compound P.

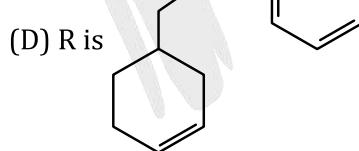
[IIT 2020]



Choose the correct option(s).



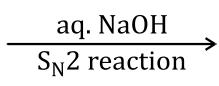
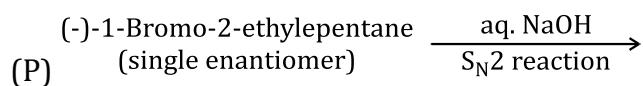
(B) X is Pd-C/quinoline/ H_2



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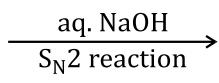
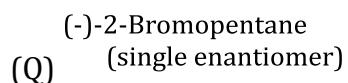
7. Match the reactions in List-I with the features of their products in List-II and choose the correct option.
[IIT 2023]

List-I

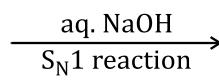
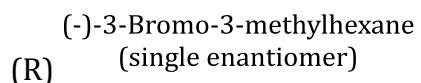


List-II

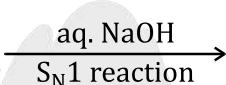
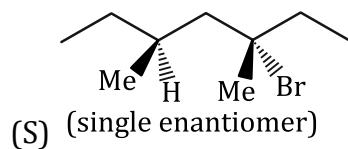
(1) Inversion of configuration



(2) Retention of configuration



(3) Mixture of enantiomers



(4) Mixture of structural isomers

(5) Mixture of diastereomers

- (A) P → 1; Q → 2; R → 5; S → 3
 (B) P → 2; Q → 1; R → 3; S → 5
 (C) P → 1; Q → 2; R → 5; S → 4
 (D) P → 2; Q → 4; R → 3; S → 5

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ANSWER KEY

EXERCISE - I (MAINS ORIENTED)

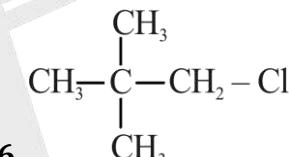
- | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|
| 1. | (C) | 2. | (C) | 3. | (B) | 4. | (D) | 5. | (B) | 6. | (B) | 7. | (C) |
| 8. | (C) | 9. | (B) | 10. | (A) | 11. | (D) | 12. | (A) | 13. | (D) | 14. | (C) |
| 15. | (D) | 16. | (D) | 17. | (A) | 18. | (D) | 19. | (A) | 20. | (B) | 21. | (C) |
| 22. | (B) | 23. | (C) | 24. | (D) | 25. | (B) | 26. | (D) | 27. | (D) | 28. | (B) |
| 29. | (B) | 30. | (C) | 31. | (A) | 32. | (A) | 33. | (D) | 34. | (D) | 35. | (D) |
| 36. | (D) | 37. | (B) | 38. | (C) | 39. | (C) | 40. | (C) | 41. | (B) | 42. | (C) |
| 43. | (B) | 44. | (A) | 45. | (A) | 46. | (C) | 47. | (A) | 48. | (BD) | 49. | (C) |
| 50. | (B) | 51. | (B) | 52. | (A) | 53. | (B) | | | | | | |

EXERCISE II-(A)

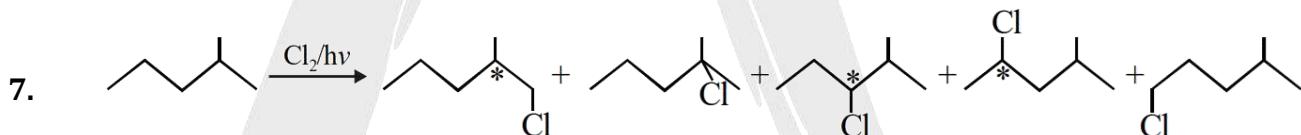
- | | | | | | | | | | | | | | |
|-----|------|-----|----|-----|-----|-----|-----|-----|-----|-----|----|-----|------|
| 1. | C | 2. | AB | 3. | ABD | 4. | ACD | 5. | BD | 6. | AB | 7. | ABCD |
| 8. | BCD | 9. | AD | 10. | AB | 11. | AC | 12. | ABD | 13. | B | 14. | C |
| 15. | ABCD | 16. | B | 17. | ABC | 18. | AC | | | | | | |

EXERCISE II-(B)

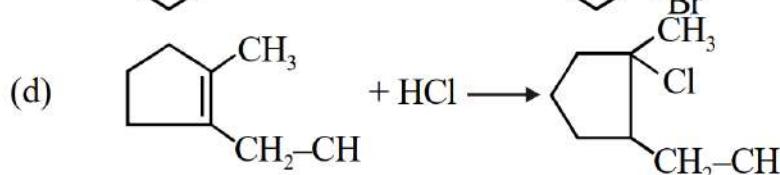
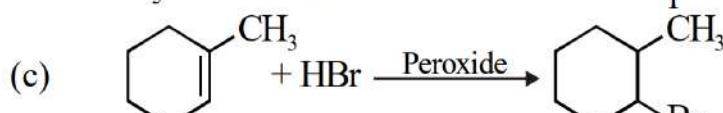
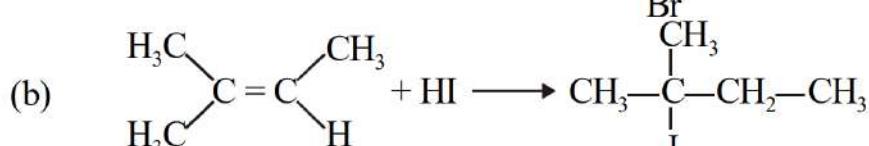
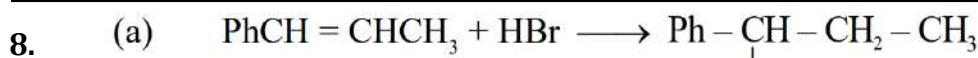
1. B 2. (A) → S, T; (B) → P, S, T; (C) → U; (D) → Q; (E) → T, U
 3. (A) → R; (B) → Q, S; (C) → P, Q; (D) → Q, S 4. (A) → P; (B) → P; (C) → Q; (D) → R;



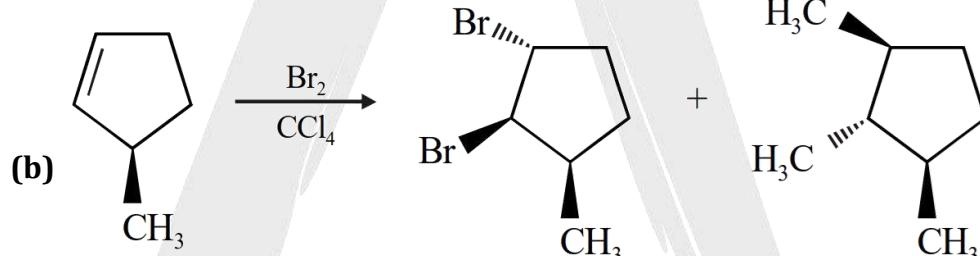
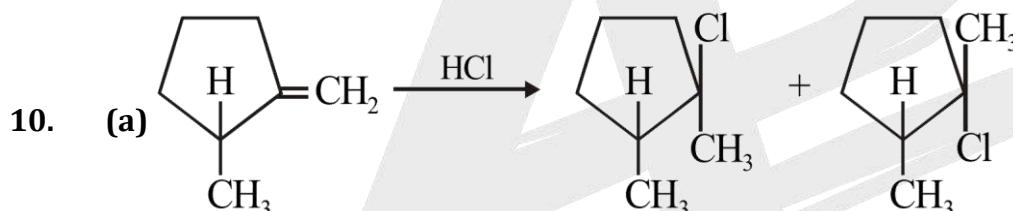
5. 1-chloro-3-methylbutane



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9. Not available.



11. Not available.

12. Not available.

13. Not available.

EXERCISE (JEE MAIN)

1. (3) 2. (4) 3. (4) 4. (2) 5. (1) 6. (1) 7. (4)

8. (3) 9. (1) 10. (3) 11. (3) 12. (C) 13. (C) 14. (C)

15. (B) 16. (C) 17. (D) 18. (C) 19. (B) 20. (B) 21. (B)

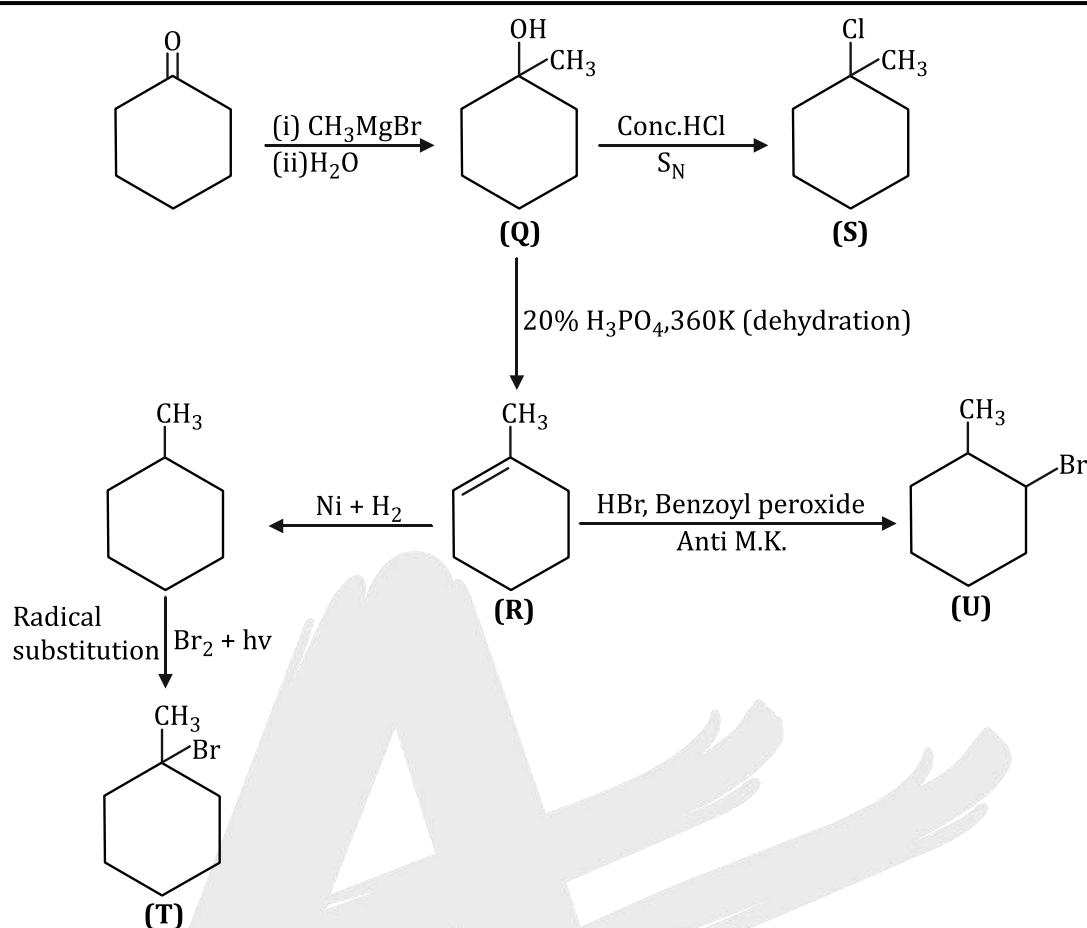
22. (B) 23. (D) 24. (D) 25. (B) 26. (A) 27. (A)

EXERCISE (JEE ADVANCE - Objective)

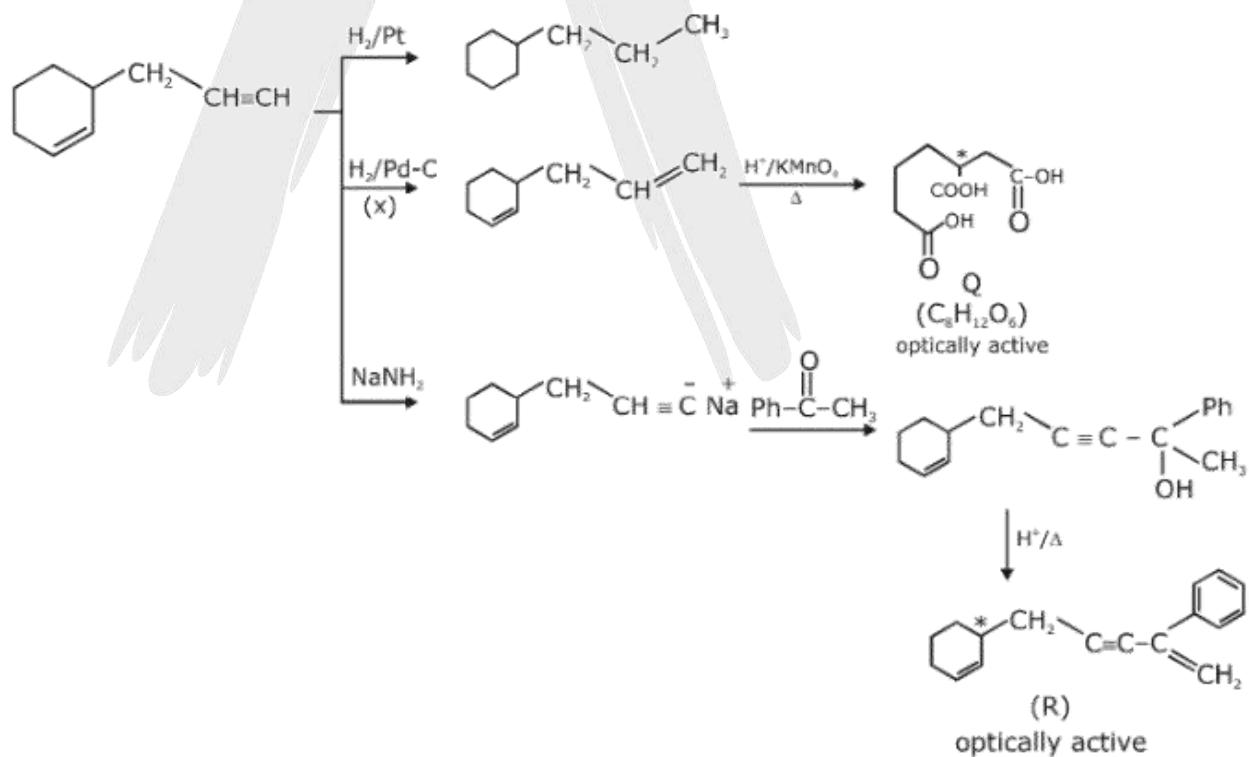
1. (A,C) 2. (C) 3. (D) 4. (A,B) 5. (A,D) 6. (B,C) 7. (B)

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5. Sol.

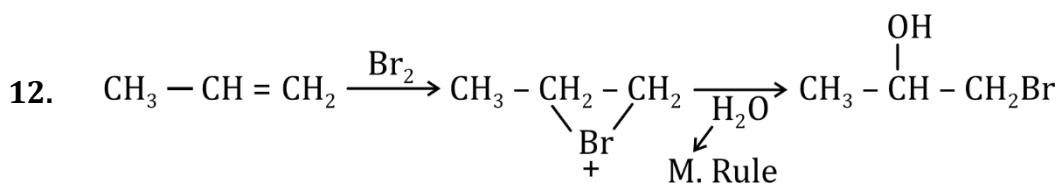


6. Sol.



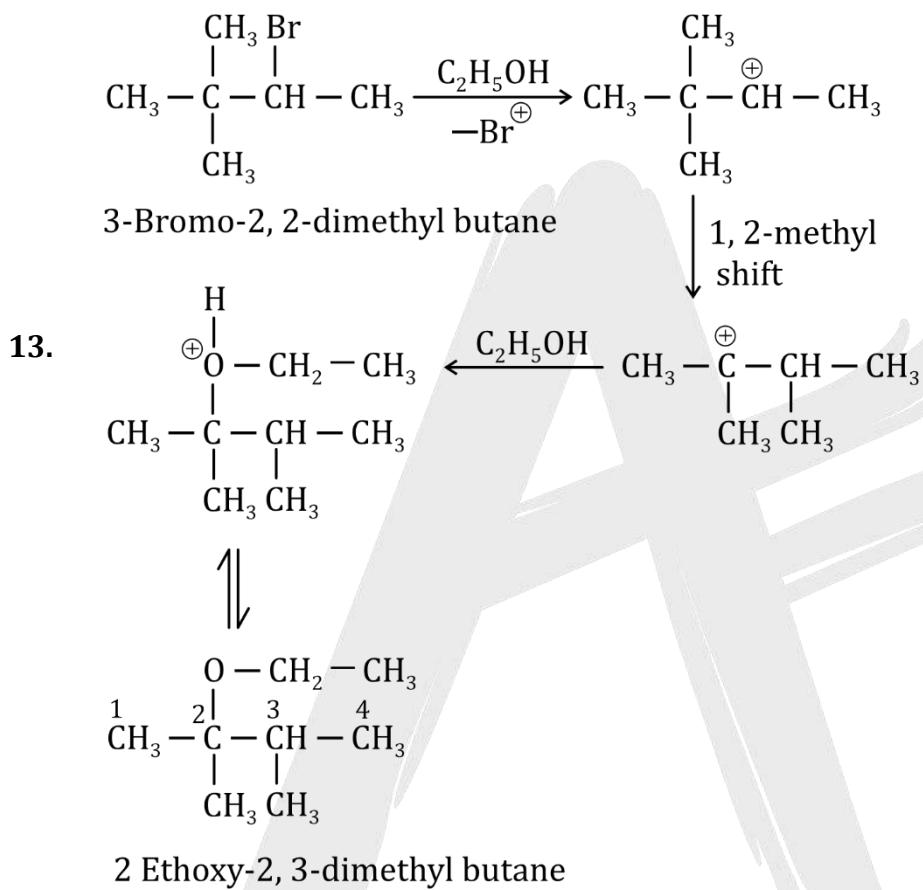
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SOLUTION



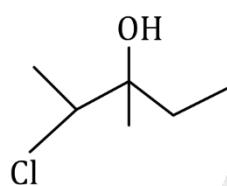
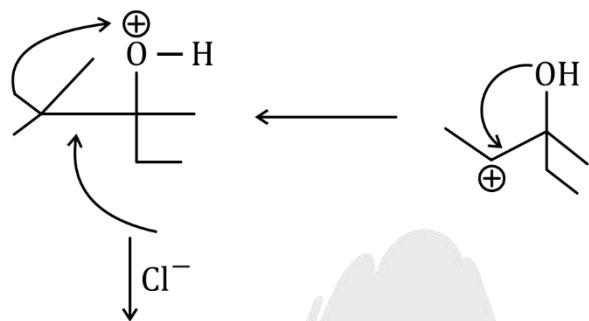
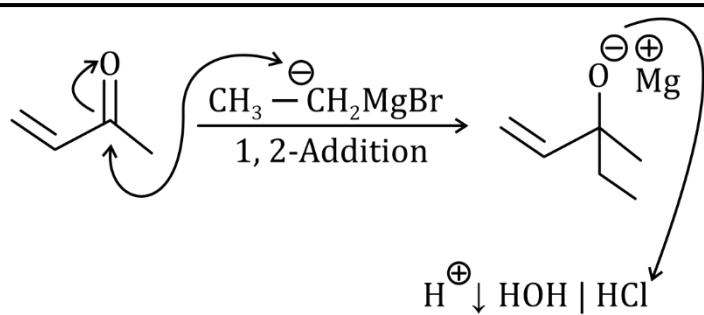
Its IUPAC name 1-bromopropan-2-ol

A and R are true and (R) is the correct explanation of (A).

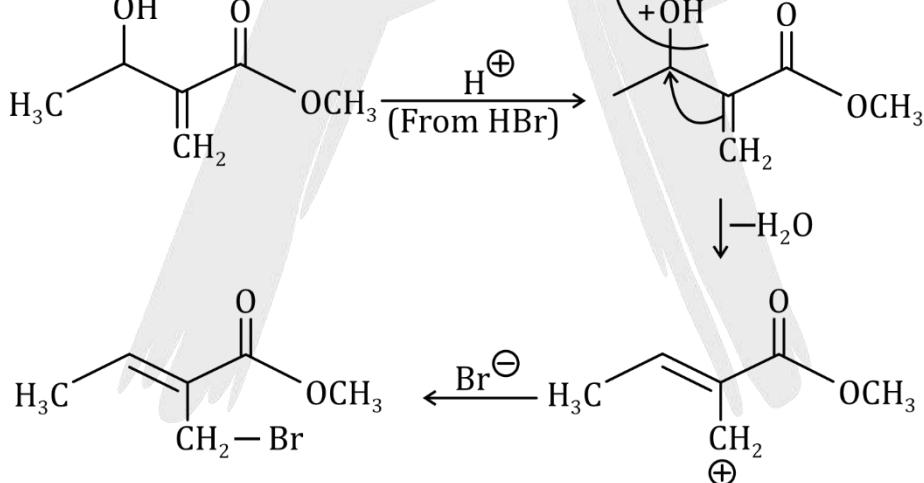


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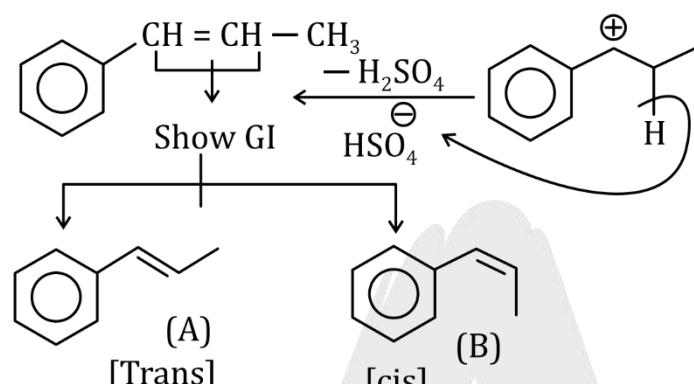
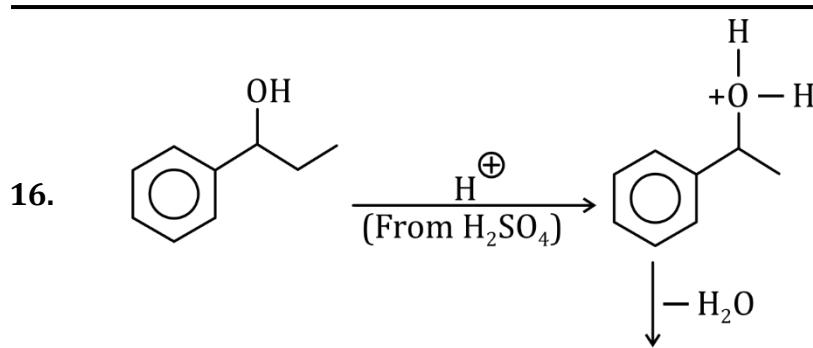
14.



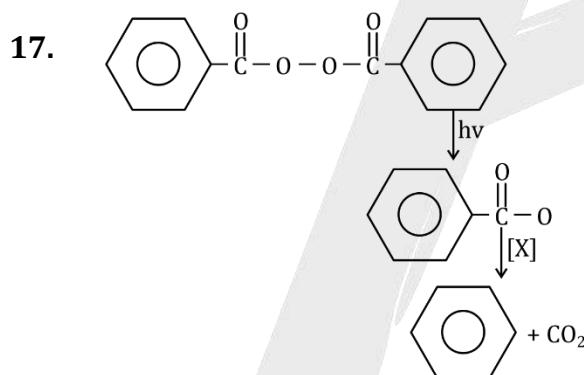
15.



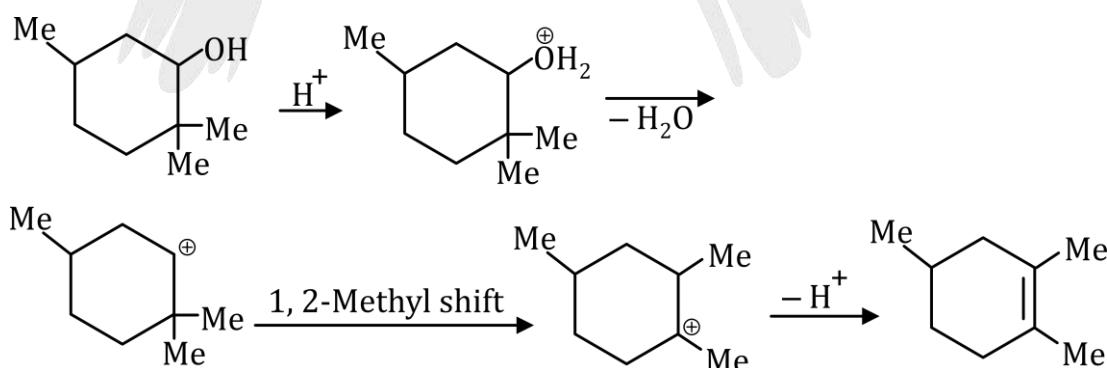
(Organic Chemistry) CARBOCATION AND FREE RADICAL



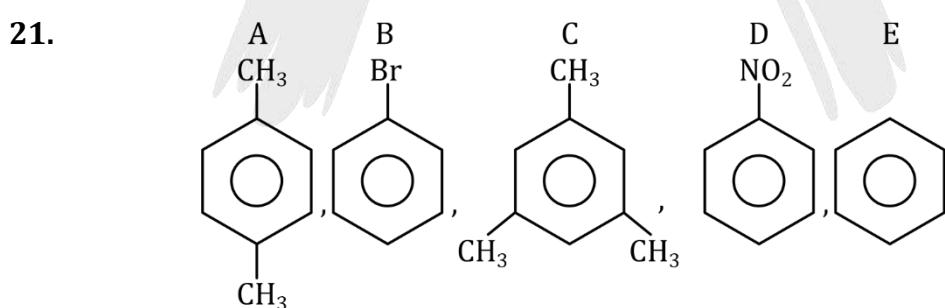
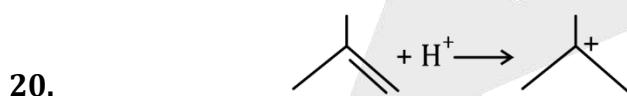
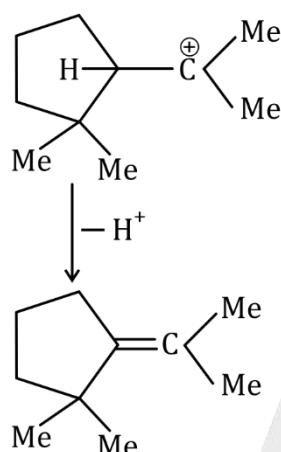
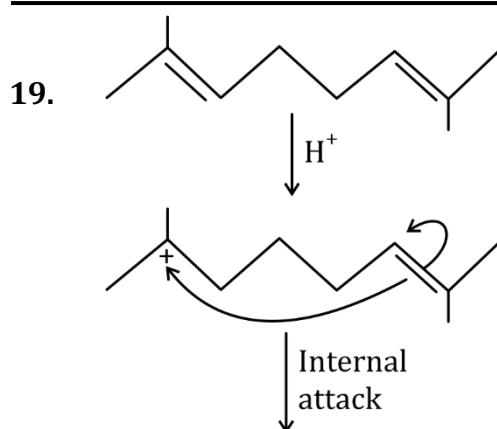
(More stable product)
(Saytzeff's Alkene)
(Major)



18.



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$-\text{NO}_2$ is strongly deactivating

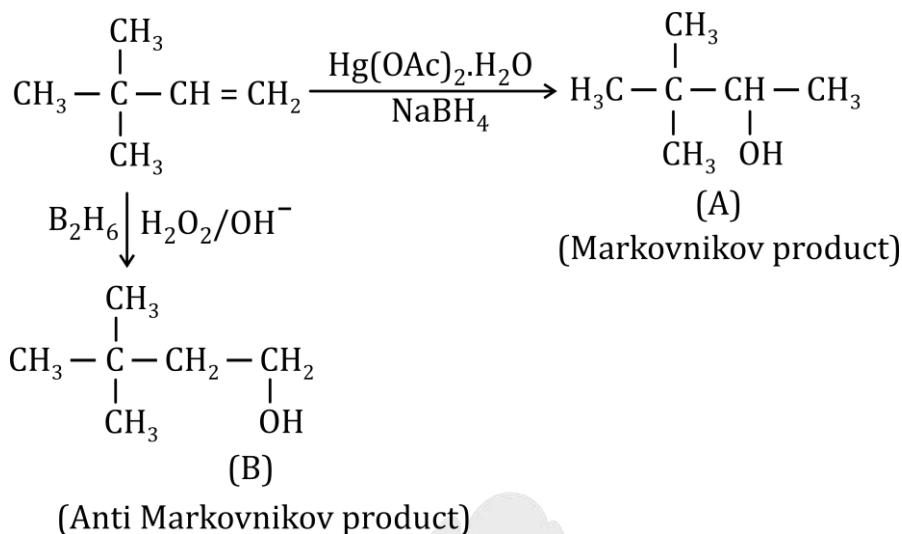
$-\text{Br}$ – deactivating

$-\text{CH}_3$ – activating group

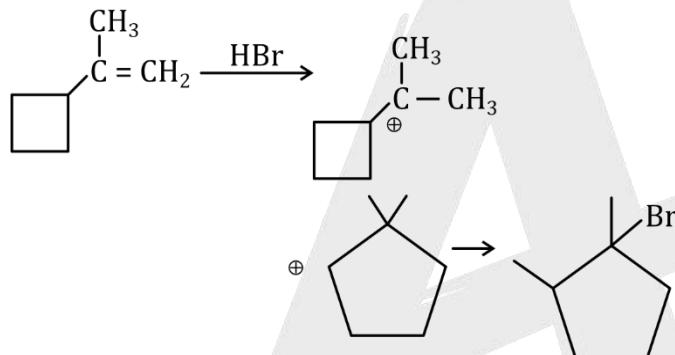
D < B < E < A < C

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22.



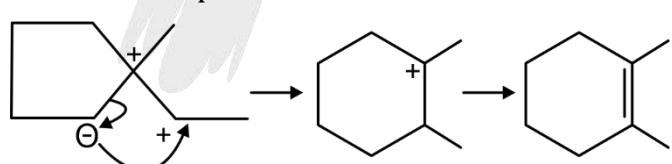
23.



- 24.** Electron withdrawing groups are highly ineffective at meta position in nucleophilic aromatic substitution reactions.

Hence compound  will have lowest

- 25



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