

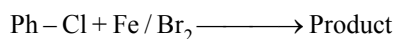
SOLVED EXAMPLES

Ex. 1 Which of the following is used as insecticide :

- (A) D.D.T. (B) Chloritone (C) Chloropicrin (D) (A) and (C) both

Ans. (D)

Ex. 2 The product in the following reaction is :



- (A) o- bromo-chloro benzene (B) p- bromo-chloro benzene
(C) (A) and (B) both (D) 2, 4, 6-tribromo chloro benzene

Ans. (C)

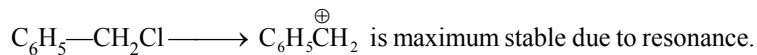
Sol. Since - Cl group is deactivating and o/p directing group so only o- and p- products are formed.

Ex. 3 The most reactive towards $\text{S}_{\text{N}}1$ is :

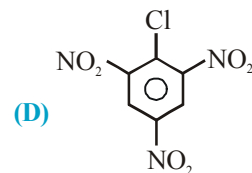
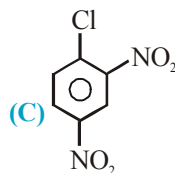
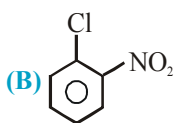
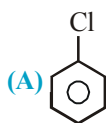
- (A) PhCH_2Cl (B) Ph-Cl (C) $\text{CH}_3\text{CHCl}(\text{CH}_3)$ (D) $\text{p-NO}_2\text{-Ph-CH}_2\text{-Cl}$

Ans. (A)

Sol. $\text{S}_{\text{N}}1$ the intermediate carbocation is formed.



Ex. 4 Which of the following undergoes Hydrolysis most easily :



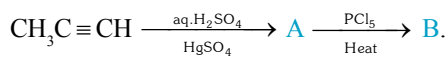
Ans. (D)

Sol. If there is more m-directing group then there will be more nucleophilic substitution reaction.

Exercise # 1

[Single Correct Choice Type Questions]

1. Consider the following reaction sequence,



The products (A) and (B) are, respectively,

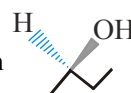
- (A) CH_3COCH_3 and $\text{CH}_3\text{CCl}_2\text{CH}_3$ (B) $\text{CH}_3\text{CH}_2\text{CHO}$ and $\text{CH}_3\text{CH}_2\text{CHCl}_2$
 (C) $\text{CH}_3\text{CHOHCH}_3$ and $\text{CH}_3\text{CHClCH}_3$ (D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$

2. Which of the following has highest dipole moment:

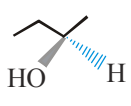
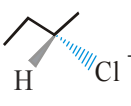
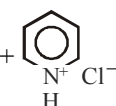
- (A) CH_3Cl (B) CH_3F (C) CH_3Br (D) CH_3I

3. In $\text{S}_{\text{N}}1$ the first step involves the formation of

- (A) free radical (B) carbanion (C) carbocation (D) final product

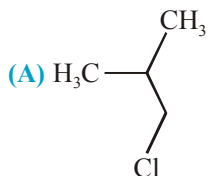
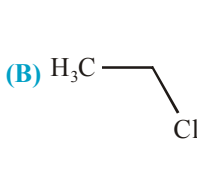
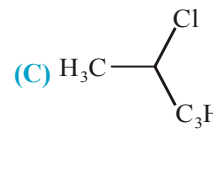
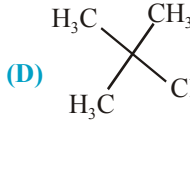
4. The product formed in the reaction  + $\text{SOCl}_2 \rightarrow$ is-

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

5. The reaction  + $\text{SOCl}_2 \xrightarrow{\text{pyridine}}$  + SO_2 + 

proceeds by the mechanism

- (A) $\text{S}_{\text{N}}1$ (B) $\text{S}_{\text{N}}2$ (C) $\text{S}_{\text{N}}\text{i}$ (D) $\text{S}_{\text{E}}2$
6. 1, 3-Dibromopropane reacts with metallic zinc to form
 (A) propene (B) cyclopropane (C) propane (D) hexane
7. To form alkane isonitrile, alkyl halide is reacted with:
 (A) KCN (B) AgCN (C) HCN (D) NH_4CN
8. Which one of the following compounds most readily undergoes substitution by $\text{S}_{\text{N}}2$ mechanism ?

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

9. Sec. Butyl chloride undergo alkaline hydrolysis in the polar solvent by

- (A) $\text{S}_{\text{N}}2$ (B) $\text{S}_{\text{N}}1$ (C) $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ (D) none of these

10. The products of reaction of alcoholic silver nitrite with ethyl bromide are

- (A) Ethane (B) Ethene (C) Ethyl alcohol (D) Nitro ethane

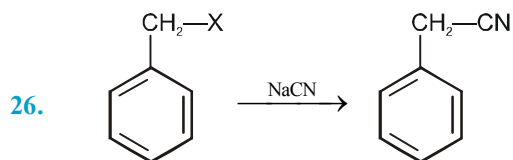
11. The reaction, $\text{CH}_3\text{Br} + \text{OH}^- \longrightarrow \text{CH}_3\text{OH} + \text{Br}^-$ obeys the mechanism
 (A) $\text{S}_{\text{N}}1$ (B) $\text{S}_{\text{N}}2$ (C) E_1 (D) E_2
12. Ethylidene chloride can be prepared by the reaction of HCl and
 (A) Ethane (B) Ethylene (C) Acetylene (D) Ethylene glycol
13. Grignard reagent can be prepared by
 (A) $\text{CH}_3\text{—CH}_2\text{—Cl} + \text{Mg} \xrightarrow[\text{ether}]{\text{dry}}$ (B) $\text{CH}_3\text{—}\underset{\text{Cl}}{\text{CH}}\text{—}\underset{\text{OH}}{\text{CH}_2} + \text{Mg} \xrightarrow[\text{ether}]{\text{dry}}$
 (C) $\text{CH}_3\text{—}\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}}\text{—OH} + \text{Mg} \xrightarrow[\text{ether}]{\text{dry}}$ (D) All of them
14. Most stable carbocation formed from $(\text{CH}_3)_3\text{C—Br}$, $(\text{C}_6\text{H}_5)_3\text{CBr}$, $(\text{C}_6\text{H}_5)_2\text{CHBr}$ and $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ would be
 (A) $\text{C}_6\text{H}_5\overset{\oplus}{\text{C}}\text{H}_2$ (B) $(\text{CH}_3)_3\overset{\oplus}{\text{C}}$ (C) $(\text{C}_6\text{H}_5)_3\overset{\oplus}{\text{C}}$ (D) $(\text{C}_6\text{H}_5)_2\overset{\oplus}{\text{C}}\text{H}$
15. For the reaction

$$\text{CH}_3\text{CH(X)CH}_2\text{CH}_3 \xrightarrow{\text{alc. KOH}} \begin{cases} \text{CH}_3\text{—CH=CH—CH}_3 \\ \text{CH}_2\text{=CH—CH}_2\text{—CH}_3 \end{cases}$$

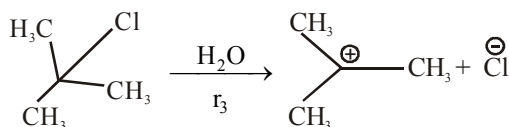
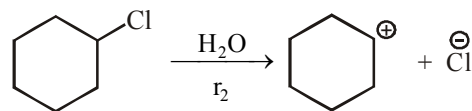
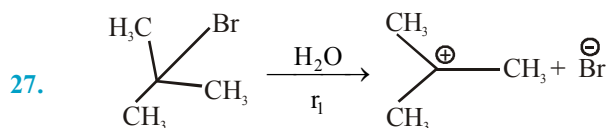
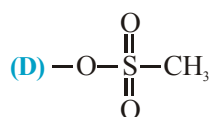
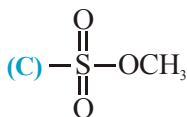
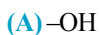
 (A) $\text{CH}_3\text{—CH=CH—CH}_3$ predominates (B) $\text{CH}_2\text{=CH—CH}_2\text{—CH}_3$ predominates
 (C) Both are formed in equal amounts (D) The product ratio depends on the halogen
16. 1-phenyl-2-chloropropane on treating with alc. KOH gives mainly
 (A) 1-phenylpropene (B) 2-phenylpropene
 (C) 1-phenylpropan-2-ol (D) 1-phenylpropan-1-ol
17. Grignard reagent is obtained when magnesium is treated with
 (A) Alkyl halide in presence of alcohol (B) Alkyl halide in presence of phenol
 (C) Alkyl halide in presence of dry ether (D) Alkyl halide in presence of alcoholated ether
18. Ethylene reacts with bromine to form -
 (A) Chloroethane (B) Ethylene dibromide (C) Cyclohexane (D) 1-bromo propane
19. The correct reactivity order of alcohols towards H-X will be
 (I) $\text{CH}_2\text{=CH—OH}$ (II) $\text{H}_3\text{C—}\underset{\text{=CH}_2}{\overset{\text{OH}}{\text{C}}}$ (III) $\text{CH}_3\text{—CH}_2\text{—OH}$ (IV) $\text{CH}_3\text{—}\underset{\text{OH}}{\text{CH}}\text{—CH}_3$
 (A) II > I > III > IV (B) IV > III > II > I (C) II > IV > I > III (D) II > IV > III > I
20. Identify 'Z' in the following reaction series, $\text{CH}_3\text{—CH}_2\text{CH}_2\text{Br} \xrightarrow{\text{aq. NaOH}} (\text{X}) \xrightarrow[\text{Heat}]{\text{Al}_2\text{O}_3} (\text{Y}) \xrightarrow{\text{HOCl}} (\text{Z})$:
 (A) Mixture of $\text{CH}_3\text{—}\underset{\text{Cl}}{\text{CH}}\text{—}\underset{\text{Cl}}{\text{CH}_2}$ and $\text{CH}_3\text{—}\underset{\text{OH}}{\text{CH}}\text{—}\underset{\text{OH}}{\text{CH}_2}$ (B) $\text{CH}_3\text{—}\underset{\text{OH}}{\text{CH}}\text{—}\underset{\text{Cl}}{\text{CH}_2}$
 (C) $\text{CH}_3\text{—}\underset{\text{Cl}}{\text{CH}}\text{—}\underset{\text{OH}}{\text{CH}_2}$ (D) $\text{CH}_3\text{—}\underset{\text{Cl}}{\text{CH}}\text{—}\underset{\text{Cl}}{\text{CH}_2}$

CHEMISTRY FOR JEE MAIN & ADVANCED

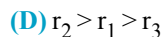
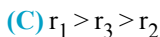
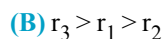
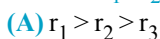
21. For the reaction,
 $C_2H_5OH + HX \xrightarrow{ZnX_2} C_2H_5X$, the order of reactivity is
 (A) $HI > HCl > HBr$ (B) $HI > HBr > HCl$
 (C) $HCl > HBr > HI$ (D) $HBr > HI > HCl$
22. $C_2H_4 \xrightarrow{Br_2} X \xrightarrow{KCN} Y$; Y is
 (A) CH_3CH_2CN (B) $NC-CH_2-CH_2-CN$
 (C) $Br-CH_2-CH_2CN$ (D) $Br-CH=CHCN$
23. Reactivity order of halides for dehydrohalogenation is
 (A) $R-F > R-Cl > R-Br > R-I$ (B) $R-I > R-Br > R-Cl > R-F$
 (C) $R-I > R-Cl > R-Br > R-F$ (D) $R-F > R-I > R-Br > R-Cl$
24. Which of the following is least reactive in a nucleophilic substitution reaction
 (A) $CH_2=CHCl$ (B) CH_3CH_2Cl
 (C) $CH_2=CHCH_2Cl$ (D) $(CH_3)_3C-Cl$
25. Ethyl alcohol reacts at a faster rate with HI than with HCl in forming the corresponding ethyl halides under identical conditions mainly because -
 (A) HI, being a stronger acid, protonates ethyl alcohol at oxygen much better and helps substitution
 (B) the bond length in HI is much shorter than that in HCl
 (C) I^- is a much better leaving group
 (D) I^- is a much better nucleophile than Cl^-



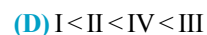
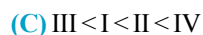
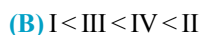
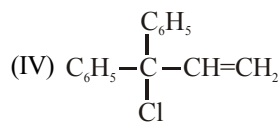
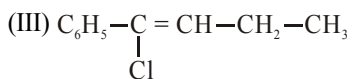
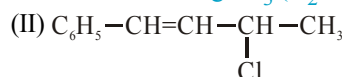
In the given reaction rate is fastest, when (X) is :



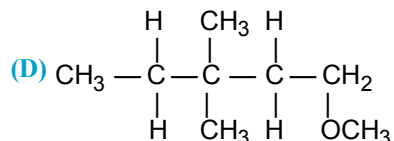
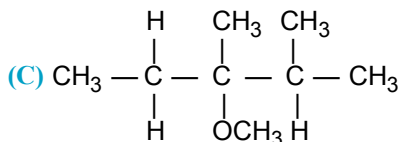
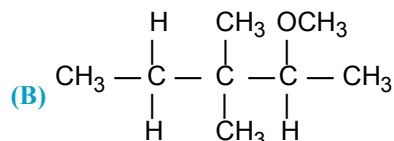
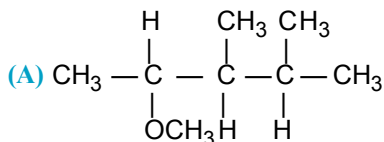
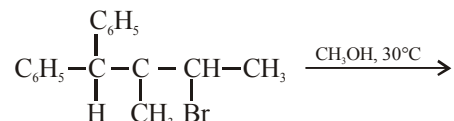
the rates r_1 , r_2 and r_3 are in the order :



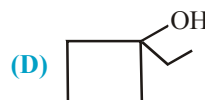
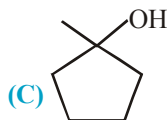
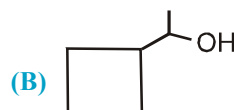
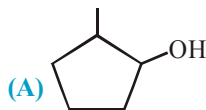
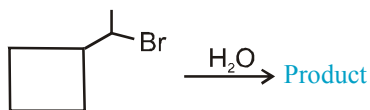
28. The increasing order of reactivity of the following isomeric halides with AgNO_3 ($\text{H}_2\text{O} + \text{alcohol}$) is :



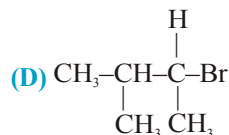
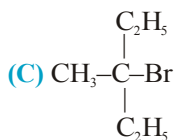
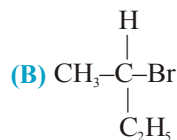
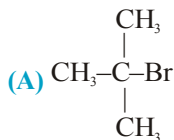
29. What will be the major product of the following reaction ?

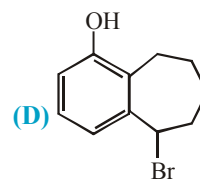
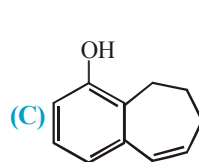
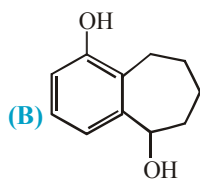
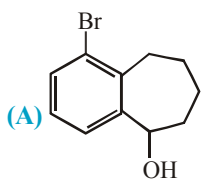
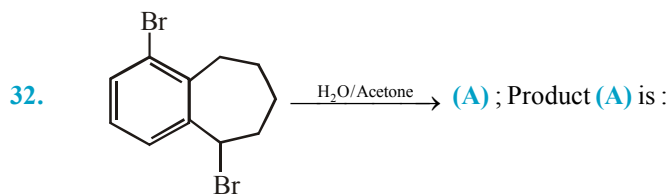


30. What will be the major product of the following reaction

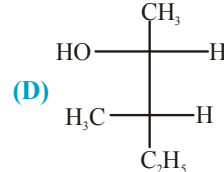
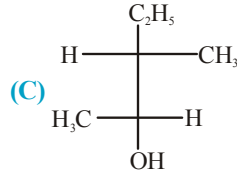
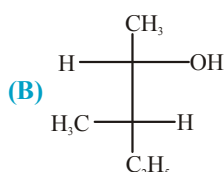
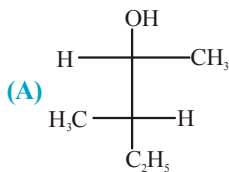
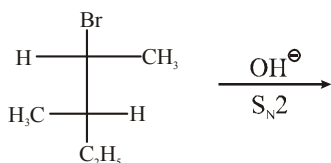


31. Which one of the following compounds will give (D) and (E) form in $\text{S}_\text{N}1$ reaction (as major product)

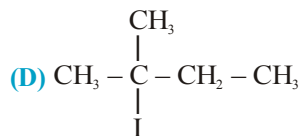
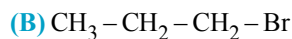
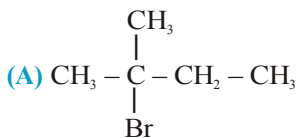




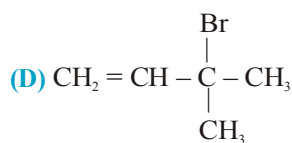
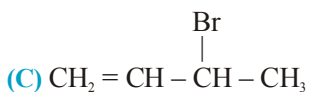
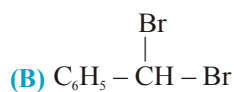
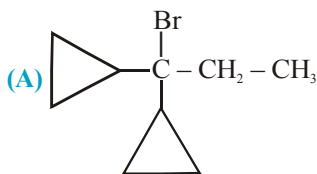
33. In the following reaction the most probable product will be :



34. Which one of the following compounds undergoes E1 reaction most readily ?



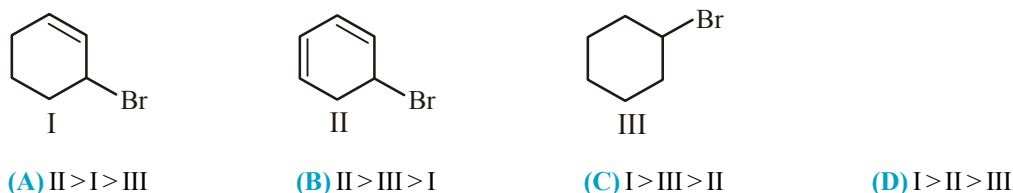
35. Which of the following will be most reactive for E1 reaction ?



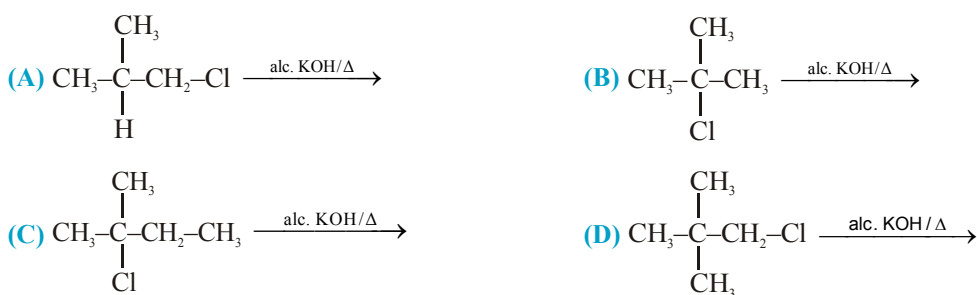
36. Which of the following cannot undergo E2 reaction ?



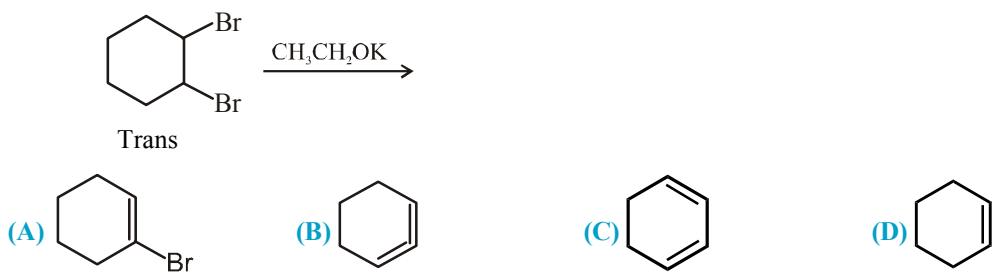
37. Arrange the following in decreasing order of stability of their transition state during elimination by strong base

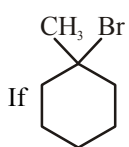
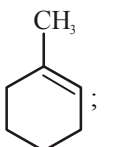


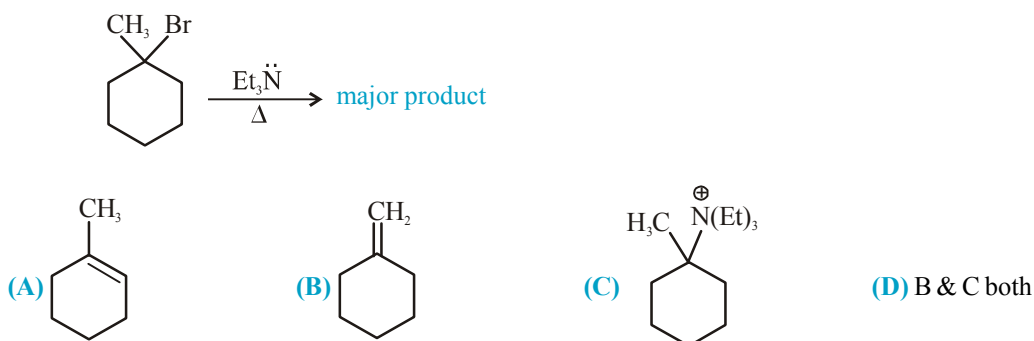
38. In which of the following reaction, regioselectivity can be observed.



39. The most probable product in the following reaction is :

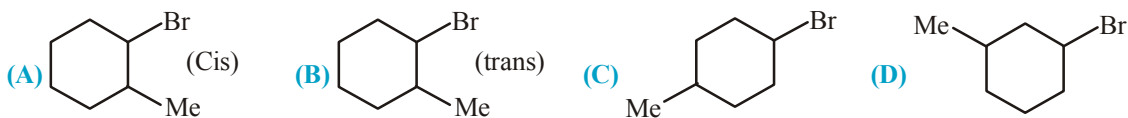


40. If  $\xrightarrow[\Delta]{\text{CH}_3\ddot{\text{N}}\text{H}_2}$  ; Then what will be the major product of the following reaction

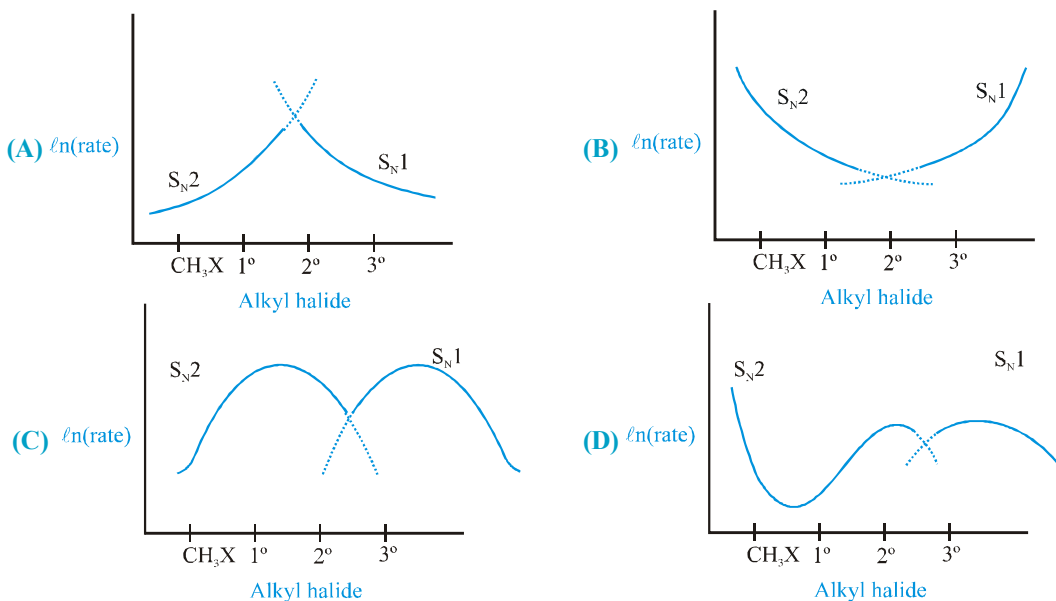


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41. Which of the following will undergo fastest elimination reaction with alcoholic KOH.



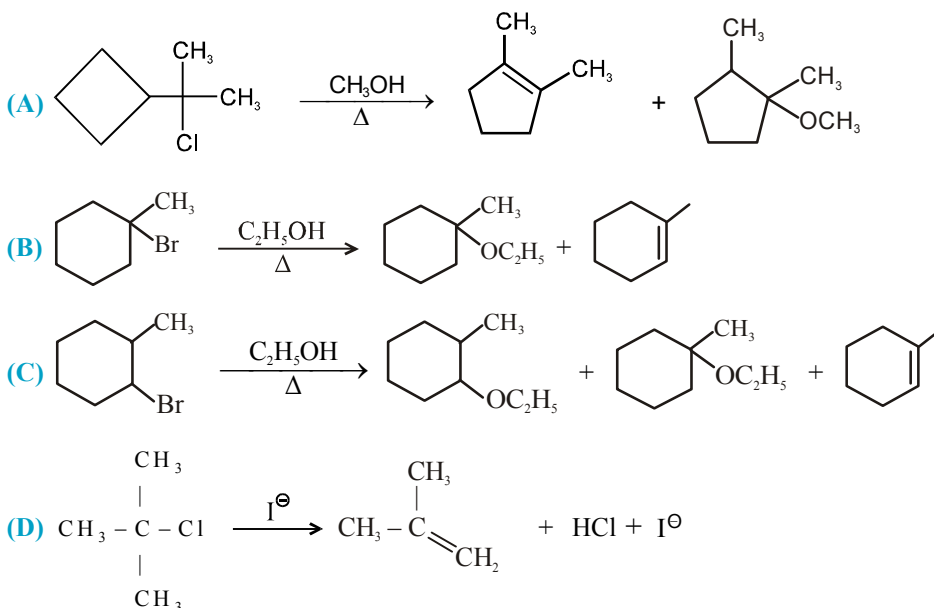
42. Which of the following curves correctly represents S_N1 vs S_N2



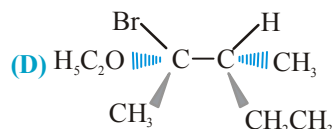
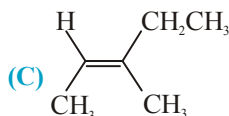
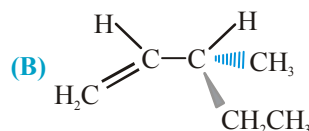
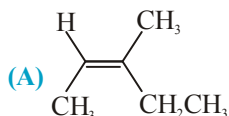
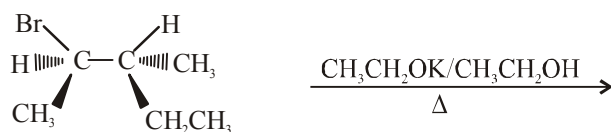
43. Aryl halides are less reactive towards nucleophilic substitution reactions as compared to alkyl halides due to

- (A) The formation of less stable carbanion
 (B) Longer carbon halogen bond
 (C) The inductive effect
 (D) sp^2 -hybridized carbon attached to the halogen

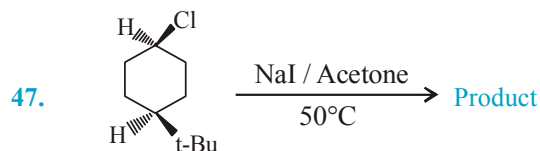
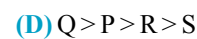
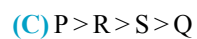
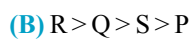
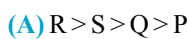
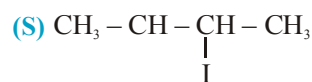
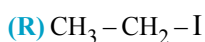
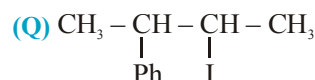
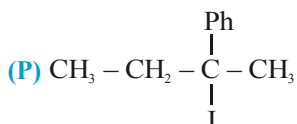
44. Which of the following reaction is not feasible.



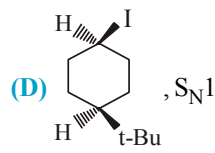
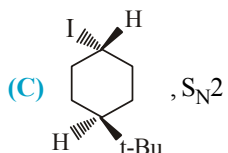
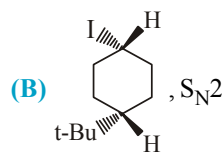
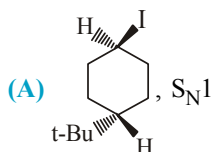
45. Select the formula representing the major product of the following reaction



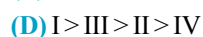
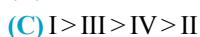
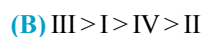
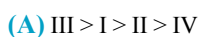
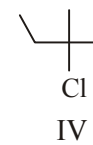
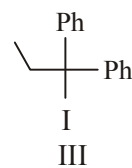
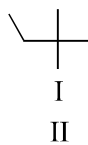
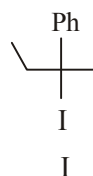
46. The correct order of S_N2 / E2 ratio for the % yield of product of the following halide is

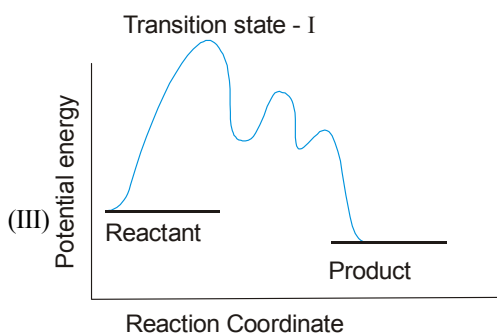


Product and mechanism are respectively



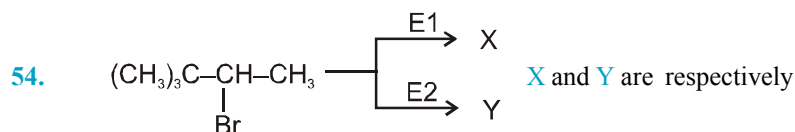
48. Which of the following order of decreasing rate of S_N reaction in $\text{CF}_3\text{CO}_2\text{H}$ is correct



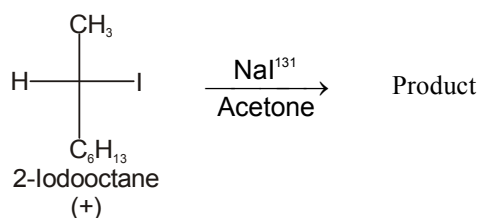


The correct statement (s) is (are)

- (A) 'I' is potential energy diagram for S_N2 reaction that takes place with a negative potential energy change.
 (B) 'II' is potential energy diagram for S_N2 reaction with a positive potential energy change
 (C) 'III' shows potential energy diagram for S_N1 reaction with large potential energy of activation for first (slowest) step
 (D) All of the above
53. An optically active, pure, four carbon containing saturated alcohol X when reacted with NaH followed by $\text{CH}_3\text{-I}$ gives a compound M. Same alcohol (X) when treated with TsCl followed by sodium methoxide gives M'. M and M' are
 (A) Identical (B) Enantiomer (C) Diastereomer (D) Geometrical isomers



- (A) $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$ and $(\text{CH}_3)_3\text{CCH}=\text{CH}_2$
 (B) $(\text{CH}_3)_3\text{CCH}=\text{CH}_2$ and $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$
 (C) $(\text{CH}_3)_2\text{CH}-\text{C}(\text{CH}_3)=\text{CH}_2$ and $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$
 (D) $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$ and $(\text{CH}_3)_2\text{CH}-\text{C}(\text{CH}_3)=\text{CH}_2$
55. Which statement is incorrect about the following reaction



- (A) The rate of these reaction depends on both $[\text{R-I}]$ and $[\text{}^{131}\text{I}^\ominus]$
 (B) Loss of optical activity was twice as fast as gain of radioactivity.
 (C) Each molecule undergoing substitution, suffers Inversion of configuration
 (D) Final solution has radioactive iodine only

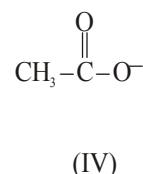
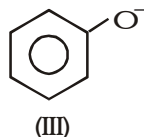
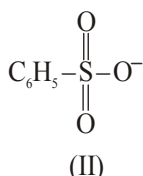
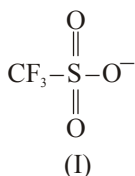
Exercise # 2

Part # I

[Multiple Correct Choice Type Questions]

1. The order of decreasing S_N1 reactivities of the halides
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ (I) $\text{CH}_2=\text{CHCHClCH}_3$ (II) $\text{CH}_3\text{CH}_2\text{CHClCH}_3$ (III)
 (A) $\text{I} > \text{II} > \text{III}$ (B) $\text{II} > \text{I} > \text{III}$ (C) $\text{II} > \text{III} > \text{I}$ (D) $\text{III} > \text{II} > \text{I}$

2. Consider the following anions.

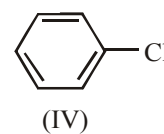
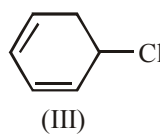
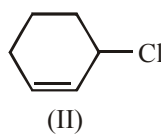
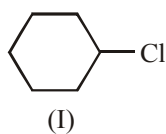


When attached to sp^3 - hybridized carbon, their leaving group ability in nucleophilic substitution reactions decreases in the order

- (A) $\text{I} > \text{II} > \text{III} > \text{IV}$ (B) $\text{I} > \text{II} > \text{IV} > \text{III}$ (C) $\text{IV} > \text{I} > \text{II} > \text{III}$ (D) $\text{IV} > \text{III} > \text{II} > \text{I}$
3. The basicity of RO^- , HO^- , RCOO^- , ROH , and H_2O are of the order -
 (A) $\text{HO}^- > \text{RO}^- > \text{H}_2\text{O} > \text{ROH} > \text{RCOO}^-$
 (B) $\text{RO}^- > \text{HO}^- > \text{RCOO}^- > \text{ROH} > \text{H}_2\text{O}$
 (C) $\text{H}_2\text{O} > \text{ROH} > \text{RCOO}^- > \text{HO}^- > \text{RO}^-$
 (D) $\text{ROH} > \text{H}_2\text{O} > \text{HO}^- > \text{RCOO}^- > \text{RO}^-$

4. Which of the following does/do produce a white precipitate of AgCl on warming with alcoholic silver nitrate?
 (A) Allyl chloride (B) t-Butyl chloride (C) Benzyl chloride (D) Vinyl chloride

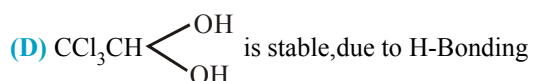
5. What is the order of reactivity of the following compounds towards nucleophilic substitution?

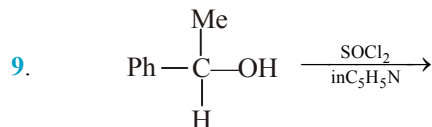


- (A) $\text{I} < \text{II} < \text{III} < \text{IV}$ (B) $\text{IV} < \text{III} < \text{II} < \text{I}$
 (C) $\text{IV} < \text{I} < \text{II} < \text{III}$ (D) $\text{IV} < \text{II} < \text{I} < \text{III}$
6. The order of decreasing nucleophilicity of the following is
 (A) $\text{H}_2\text{O} > \text{OH}^- > \text{CH}_3\text{COO}^- > \text{CH}_3\text{O}^-$ (B) $\text{CH}_3\text{O}^- > \text{OH}^- > \text{CH}_3\text{COO}^- > \text{H}_2\text{O}$
 (C) $\text{CH}_3\text{COO}^- > \text{CH}_3\text{O}^- > \text{OH}^- > \text{H}_2\text{O}$ (D) $\text{HO}^- > \text{CH}_3\text{O}^- > \text{CH}_3\text{COO}^- > \text{H}_2\text{O}$

7. Which of the following are aprotic solvents :
 (A) DMSO (B) DMF (C) H_2O (D) CH_3COOH

8. Which is/are true statements (s) :
 (A) Protonation increases electrophilic nature of carbonyl group
 (B) CF_3SO_3^- is better leaving group than CH_3SO_3^-
 (C) Benzyl carbonium ion is stabilised by resonance

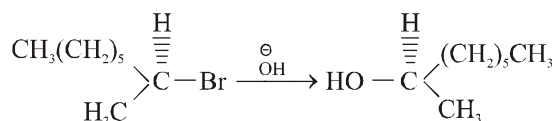




Which statement is true for the above reaction ?

- (A) Retention of configuration (B) Inversion of configuration
(C) Inversion and Retention both (D) None

10. Following reaction is



- (A) E_1 (B) $\text{S}_{\text{N}}1$ (C) E_2 (D) $\text{S}_{\text{N}}2$

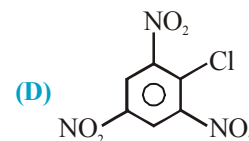
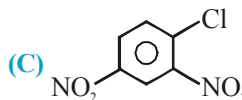
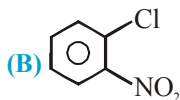
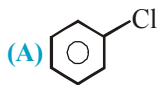
11. On treatment with chlorine in presence of sunlight, toluene gives the product -

- (A) o-chloro toluene (B) 2, 5-dichloro toluene
(C) p-chloro toluene (D) Benzyl chloride

12. In $\text{S}_{\text{N}}1$ reaction an optically active substrates mainly gives :

- (A) Retention in configuration (B) Inversion in configuration
(C) Racemic product (D) No product

13. Which of the following undergoes hydrolysis most easily



14. A compound 'A' formula of $\text{C}_3\text{H}_6\text{Cl}_2$ on reaction with alkali can give 'B' of formula $\text{C}_3\text{H}_6\text{O}$ or 'C' of formula C_3H_4 . 'B' on oxidation gave a compound of the formula $\text{C}_3\text{H}_6\text{O}_2$. 'C' with dilute H_2SO_4 containing Hg^{2+} ion gave 'D' of formula $\text{C}_3\text{H}_6\text{O}$, which with bromine and alkali gave the sodium salt of $\text{C}_2\text{H}_4\text{O}_2$. Then 'A' is

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

15. Isobutyl magnesium bromide with dry ether and absolute alcohol gives

- (A) $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{MgBr}$ (B) $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{CH}_2-\text{CH}_3$ and $\text{Mg}(\text{OH})\text{Br}$
(C) $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_3$, $\text{CH}_2=\text{CH}_2$ and $\text{Mg}(\text{OH})\text{Br}$ (D) $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{OMgBr}$

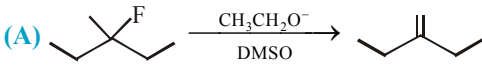

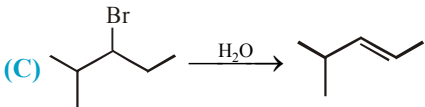
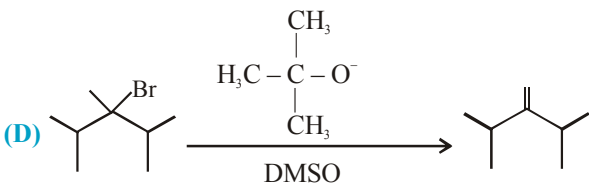
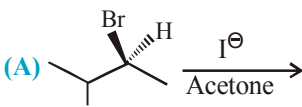
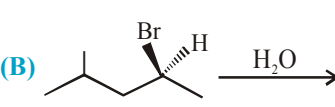
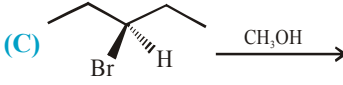
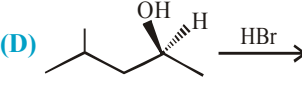
16. Alkyl iodides can be prepared by :-

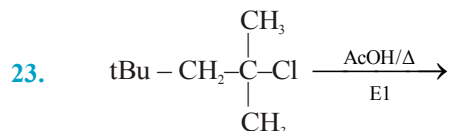
- (A) $\text{RCH}_2\text{COOAg} + \text{I}_2 \xrightarrow[\Delta]{\text{CCl}_4} \text{RCH}_2\text{I}$ (B) $\text{RCH}_2\text{Cl} + \text{NaI} \xrightarrow[\Delta]{\text{acetone}} \text{RCH}_2\text{I} + \text{NaCl}$
(C) $\text{R}-\text{OH} + \text{HI} \longrightarrow \text{RI} + \text{H}_2\text{O}$ (D) $\text{CH}_4 + \text{I}_2 \longrightarrow \text{CH}_3\text{I}$

17. Which of the following reagents can be used to prepare an alkyl halide :-

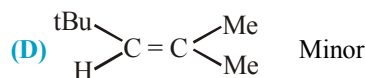
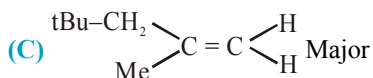
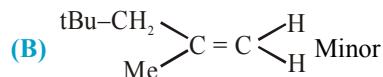
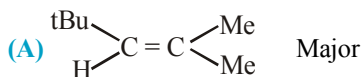
- (A) NaCl (B) $\text{HCl} + \text{ZnCl}_2$ (C) SOCl_2 (D) PCl_5

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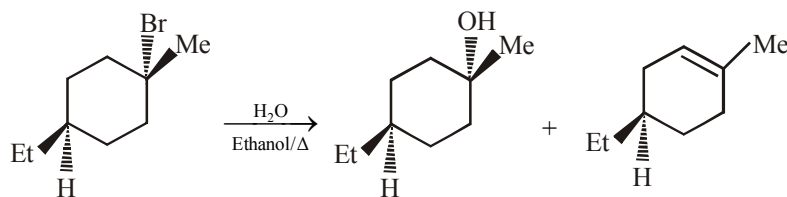
18. Which of the following reactions depict the nucleophilic substitution of C_2H_5Br :-
- (A) $C_2H_5Br + C_2H_5SNa \longrightarrow C_2H_5SC_2H_5 + NaBr$
 (B) $C_2H_5Br \xrightarrow{Na+C_2H_5OH} C_2H_6 + HBr$
 (C) $C_2H_5Br + AgCN \longrightarrow C_2H_5NC + AgBr$
 (D) $C_2H_5Br + KOH \longrightarrow C_2H_5OH + KBr$
19. For an S_N2 reaction, which of the following statements are true :-
- (A) The rate of reaction is independent of the concentration of the nucleophile
 (B) The nucleophile attacks the C-atom on the side of the molecule opposite to the group being displaced
 (C) The reaction proceeds with simultaneous bond formation and rupture
 (D) None of these
20. Which of the following is an S_N2 reaction :-
- (A) $CH_3CH_2Br + KOH \longrightarrow CH_3CH_2OH + KBr$
 (B) $CH_3CH_2Br + CH_3CH_2ONa \longrightarrow CH_3CH_2OCH_2CH_3 + NaBr$
 (C) $(CH_3)_3CBr + KOH \longrightarrow (CH_3)_3COH + KBr$
 (D) $CH_3-CH_2-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}}-Br + KOH \longrightarrow CH_3CH_2-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}}-OH + KBr$
21. Which of the following reactions represent the major product.
- (A) 
- (B) 
- (C) 
- (D) 
22. Which reaction results in the formation of a pair of enantiomers ?
- (A) 
- (B) 
- (C) 
- (D) 



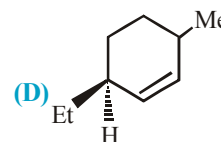
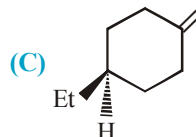
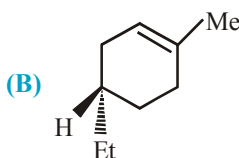
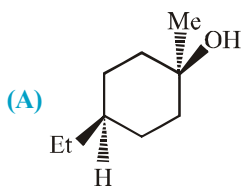
The products of the above reaction ?



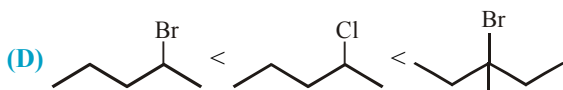
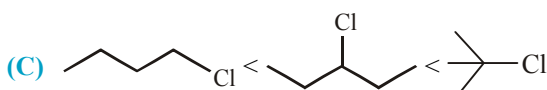
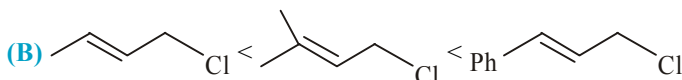
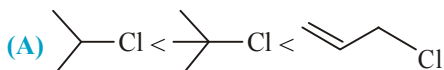
24. Consider the following E1/S_N1 reaction :



The missing product (s) is (are) :



25. Which of the following order is/are correct for the solvolysis in 50% aqueous ethanol at 44.6°C.



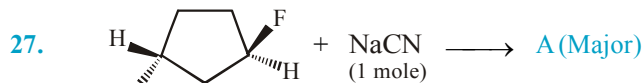
26. The relative rates of nucleophilic substitution for the given substrates are as follows

Compound	Approx. Relative rate
CH ₃ CH ₂ Br	1.0
CH ₃ CH ₂ CH ₂ Br	0.28
(CH ₃) ₂ CHCH ₂ Br	0.030
(CH ₃) ₃ CCH ₂ Br	0.0000042

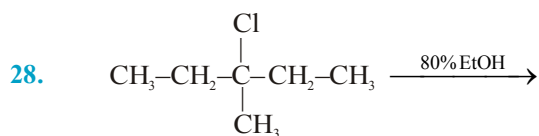
The correct statement (s) is/are :

- (A) Each of the above reactions is likely to be S_N2
 (B) Each of the above reactions is likely to be S_N1
 (C) First two reactions follow S_N2 and next two reactions follow S_N1 pathway
 (D) The important factor behind this order of reactivity is “steric effect”

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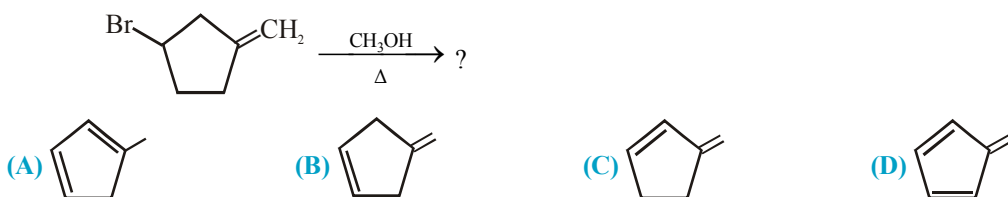
major product of this reaction is.



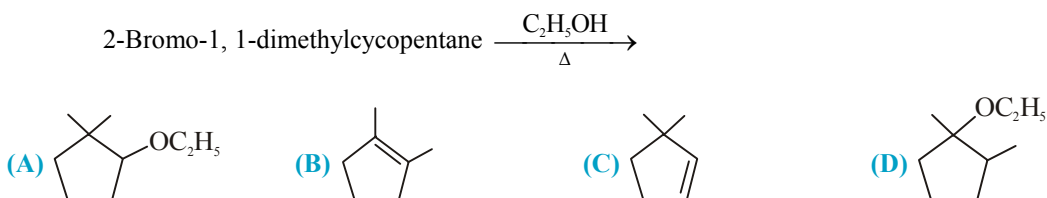
What is / are true about above reaction ?

- (A) Major product is given by $\text{S}_{\text{N}}1$ reaction.
 (B) Through E1 mechanism 3 alkenes are formed.
 (C) 3-Methylpentan-3-ol is also formed as one of the product.
 (D) Fractional distillation of elimination product will give two fractions.

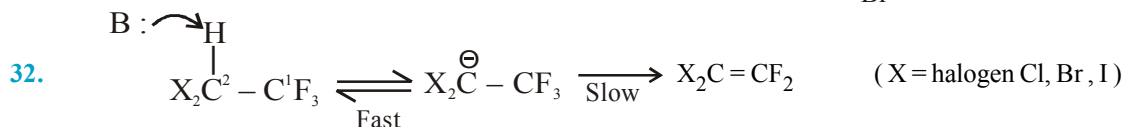
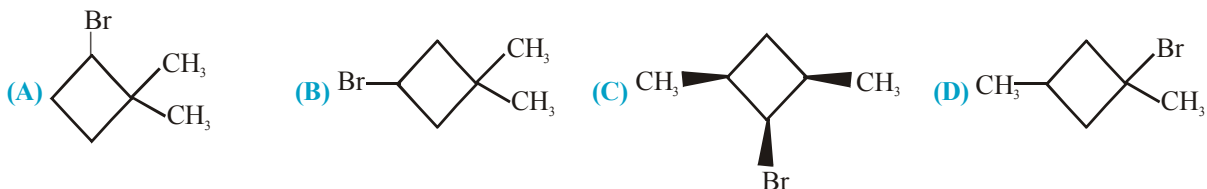
29. Which of the following is/are possible product formed by E1 mechanism for given reaction ?



30. Predict the products expected in given reaction



31. Which of the following compound (s) will yield exclusive (only one) product on dehydrohalogenation by a strong base.



Correct statement (s) is (are)

- (A) X being electronegative, makes the H (on C-2) more acidic.
 (B) Due to electron withdrawal nature of X, it stabilises the carbanion
 (C) (X) destabilises the carbanion due to the presence of lone pairs.
 (D) The reaction proceeds by an E1 cB pathway.

These questions contains, **Statement-I (assertion) and Statement-II (reason).**

- (A) Statement-I is True, Statement-II is True ; Statement-II is a correct explanation for Statement-I
 (B) Statement-I is True, Statement-II is True ; Statement-II is NOT a correct explanation for Statement-I
 (C) Statement-I is True, Statement-II is False.
 (D) Statement-I is False, Statement-II is True.

- Statement-1 :** In the E2 elimination β -H and leaving group must be antiperiplanar.
Statement-2 : In the E2 elimination base abstracts unhindered β -H.
- Statement-1 :** Aryl halides undergo nucleophilic substitution with ease.
Statement-2 : The carbon halogen bond in aryl halides has partial double bond character.
- Statement-1 :** S_N2 reaction is carried out in the presence of polar aprotic solvents.
Statement-2 : Polar aprotic solvents do not contain acidic hydrogen.
- Statement-1 :** Iodide (I^-) is the strongest nucleophile (in protic solvent) among the halide anions
Statement-2 : Iodide is the largest halide anion and is the most weakly solvated in a protic solvent
- Statement-I :** Primary benzylic halides are more reactive than primary alkyl halides towards S_{N1} reaction.
Statement-II : Reactivity depends upon the nature of the nucleophile and the solvent.
- Statement-I :** Vinylic halides are reactive towards nucleophilic substitution reaction.
Statement-II : Reactivity is due to the polarity of carbon-halogen bond.
- Statement-I :** Aryl halides undergo electrophilic substitution less readily than benzene.
Statement-II : Aryl halide gives only meta product w.r.t. electrophilic substitution.
- Statement-I :** Iodination of alkanes is carried out by heat in presence of reducing agent.
Statement-II : Iodination of alkanes take place explosively.
- Statement-I :** Chloropropane has higher boiling point than chloroethane.
Statement-II : Haloalkanes are polar molecules.
- Statement-I :** Polar solvent slows down S_{N2} reaction.
Statement-II : CH_3-Br is less reactive than CH_3Cl .
- Statement-I :** Optically active 2-iodobutane on treatment with NaI in acetone undergoes racemisation.
Statement-II : Repeated Walden inversions on the reactant and its product eventually gives a racemic mixture.
- Statement-I :** Free radical chlorination of n-butane gives 72% of 2-chlorobutane and 28% of 1-chlorobutane though it has six primary and four secondary hydrogens.
Statement-II : A secondary hydrogen is abstracted more easily than the primary hydrogen.
- Statement-I :** Nucleophilic substitution reaction on an optically active alkyl halide gives a mixture of enantiomers.
Statement-II : The reaction occurs by S_{N1} mechanism.
- Statement-I :** Boiling point of alkyl halide increases with increase in molecular weight.
Statement-II : Boiling point of alkylhalides are in the order $RI > RBr > RCl > RF$.

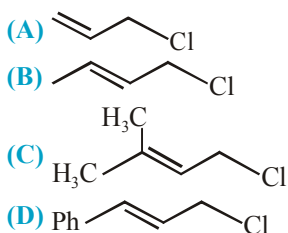
Exercise # 3

Part # I

[Matrix Match Type Questions]

1. Match the column I with column II.

Column-I
(Substrate)



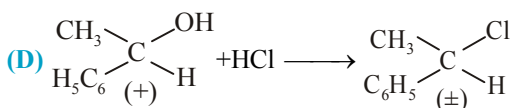
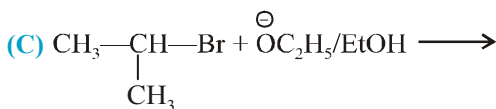
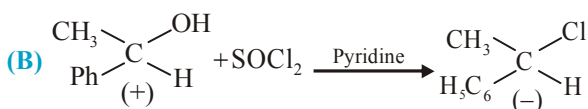
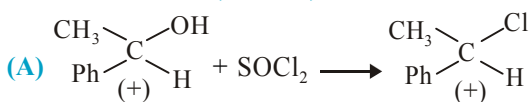
Column-II

(Relative rate of solvolysis in 50% aqueous ethanol at 45°C)

- (p) 7700
(q) 1
(r) 91
(s) 1,30,000

2. Match the column I with column II.

Column-I (reaction)

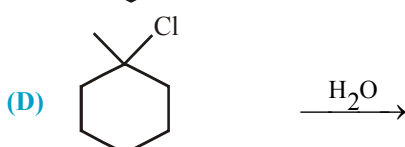
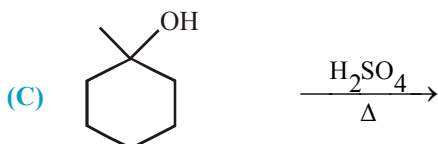
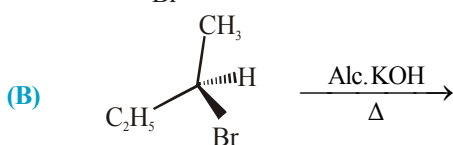


Column-II (Mechanism)

- (p) S_N1
(q) S_N2
(r) S_Ni
(s) E₂

3. Match the column I and II.

Column I
Reaction



Column II

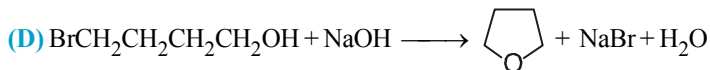
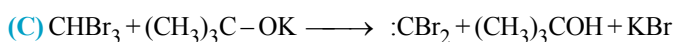
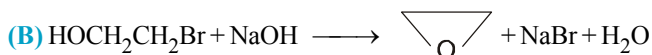
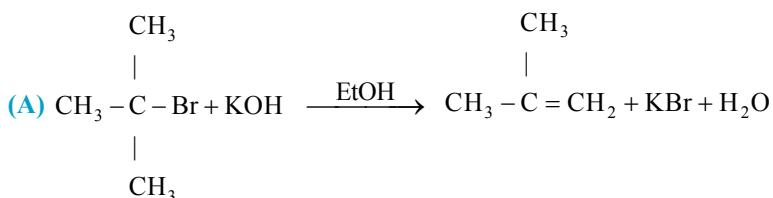
Type of reaction

- (p) S_N1
(q) S_N2
(r) E1
(s) E2

Comprehension # 1

Removal of two atoms or two groups from the substrate is known as elimination reaction. Elimination reaction is always endothermic reaction. The most common elimination reactions are α and β eliminations. The presence of at least one hydrogen on the α -carbon is necessary for α -elimination and on β -carbon is necessary for β -elimination. The driving forces for elimination are (A) stability of the olefin formed and (B) the relief from steric strain due to crowding in the substrate.

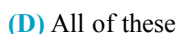
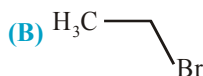
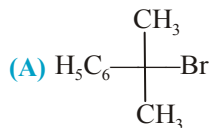
- Which one of the following compounds can give α -elimination with alc KOH/ Δ ?
 (A) CCl_4 (B) CBr_4 (C) CH_2Cl_2 (D) CBr_2Cl_2
- Which of the following alkyl halide is likely to undergo β -elimination most readily
 (A) Ethyl bromide (B) n-Propyl bromide
 (C) iso-Propyl bromide (D) tert-Butyl bromide
- Which of the following is a β -elimination reaction ?



Comprehension # 2

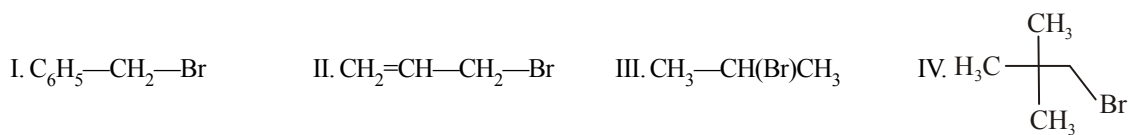
Nucleophilic aliphatic substitution reaction is mainly of two types : $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$. The $\text{S}_{\text{N}}1$ mechanism is a two step process. Reaction velocity of $\text{S}_{\text{N}}1$ reaction depends only on the concentration of the substrate. Since product formation takes place by the formation of carbocation, optically active substrate gives (+) and (-) forms of the product. In most of the cases the product usually consists of 5-20% inverted product and 80-95% racemised species. The more stable the carbocation, the greater is the proportion of racemisation. In solvolysis reaction, the more nucleophilic the solvent, the greater is the proportion of inversion.

- Which one of the following compound will give $\text{S}_{\text{N}}1$ reaction predominantly ?



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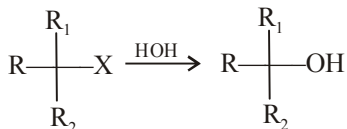
2. Which of the following compounds will give S_N1 and S_N2 reactions with considerable rate ?



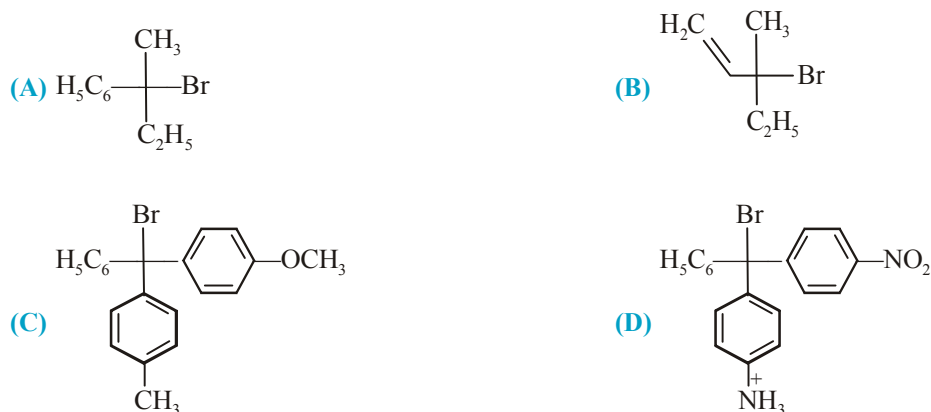
Select the correct answer from the codes given below

- (A) I, II and III (B) I, II and IV (C) II, III and IV (D) I, III and IV

3. For the given reaction



Which substrate will give maximum racemisation ?



Comprehension # 3

Nucleophilic substitution reactions generally expressed as

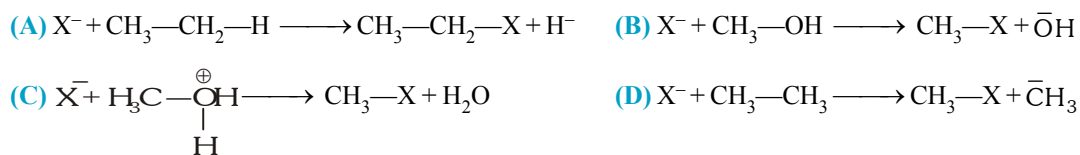


Where $Nu^- \longrightarrow$ Nucleophile ; $R-L \longrightarrow$ substrate ; $L \longrightarrow$ leaving group

The best leaving groups are those that become the most stable ions after they depart. Since most leaving groups leave as a negative ion, the best leaving groups are those ions that stabilize a negative charge most effectively. A good leaving group should be

- (A) electron-withdrawing to polarize the carbon
 (B) stable once it has left (not a strong base)
 (C) polarisable- to maintain partial bonding with the carbon in the transition state (both S_N1 and S_N2). This bonding helps to stabilise the transition state and reduces the activation energy.

1. Among the following which is feasible ?



2. Among the following which is false statement ?
- (A) The weaker the base after the group departs, the better the leaving group
 (B) A reactive leaving group would raise the energy of the product, driving the equilibrium towards the reactants
 (C) Relative leaving group ability may vary with change of solvent
 (D) Better leaving group only increases S_N2 rate, not S_N1 .

3. CH_3Br (I) CH_3F (II) CH_3OH (III) $\text{CH}_3\text{OSO}_2\text{CF}_3$ (IV)

The correct order of decreasing reactivity of the above compounds towards CH_3O^- in an S_N2 reaction is :

- (A) I > IV > II > III (B) IV > I > II > III (C) IV > I > III > II (D) IV > II > I > III
4. Cl^- (I) CH_3O^- (II) CH_3S^- (III) I^- (IV)

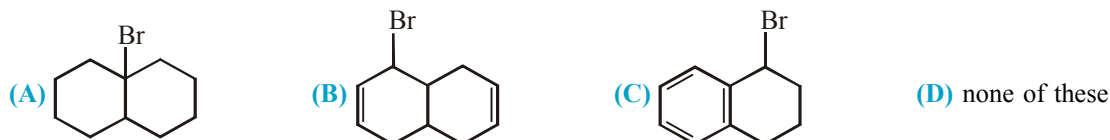
The correct order of increasing leaving group capability of above anions

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

Comprehension # 4

An organic compound A has molecular formula $\text{C}_{10}\text{H}_{17}\text{Br}$ and it is non-resolvable. A does not decolourize brown colour of bromine water solution. A on treatment with $(\text{CH}_3)_2\text{COK}/(\text{CH}_3)_3\text{COH}$ yields B as major product. B on treatment with H_2/Pt yields $(\text{C}_{10}\text{H}_{16})$ which on treatment with $\text{Cl}_2/h\nu$ yields three monochloro derivative. Also B on boiling with acidic permanganate solution yields $\text{C}(\text{C}_{10}\text{H}_{16}\text{O}_3)$. C on heating with sodalime yields D ($\text{C}_9\text{H}_{16}\text{O}$). D on reducing with LiAlH_4 followed by heating the product with concentrated H_2SO_4 yields E (C_9H_{16}) as major product. E on treatment with ozone followed by work-up with $\text{Zn-H}_2\text{O}$ yields 6-Ketnonanal.

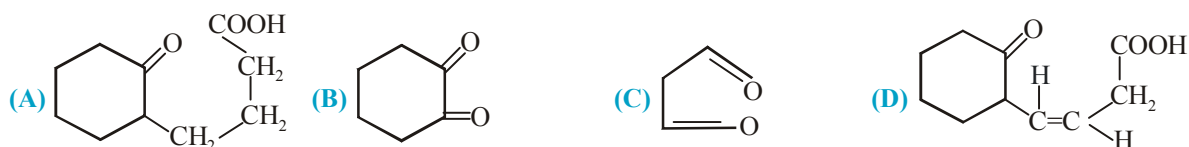
1. Compound A is :



2. Compound B is :



3. Compound C is :



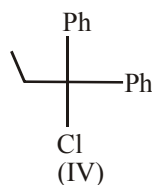
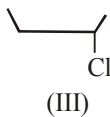
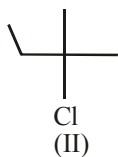
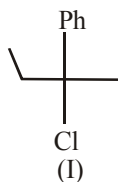
4. Compound D is :



Exercise # 4

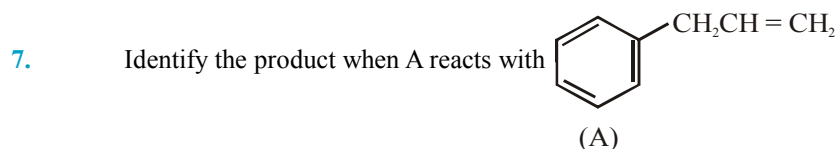
[Subjective Type Questions]

- Of the following statements, which are true for S_N2 reaction.
 - Tertiary alkyl halides reacts faster than secondary.
 - The absolute configuration of product is opposite to that of the reactant when an optically active substrate is used.
 - The reaction shows first order kinetics.
 - The rate of the reaction depends markedly on the nucleophilicity of the attacking reagent.
 - The mechanism is one step.
 - Carbocations are intermediate.
 - Rate \propto [Alkyl halides]
 - The rate of the reaction depends on the nature of the leaving group.
- Arrange the isomers of molecular formula C_4H_9Cl in order of decreasing rate of reaction with sodium iodide in acetone.
- There is an overall 29-fold difference in reactivity of 1-chlorohexane, 2-chlorohexane towards potassium iodide in acetone. Which one is the most reactive ? why ?
- Arrange the following compounds in order of :
Decreasing S_N1 reaction rate :



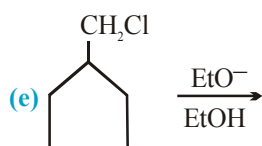
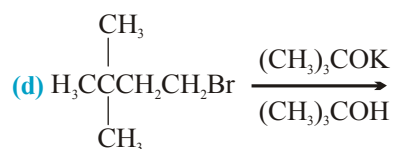
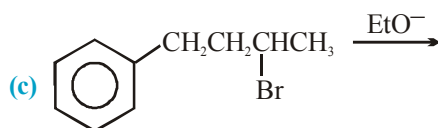
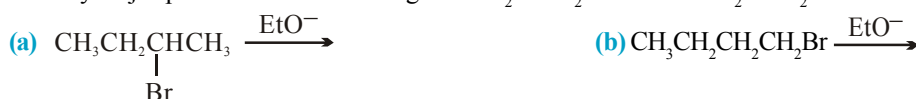
- Select the member of each pair that shows faster rate of S_N2 reaction with KI in acetone.
 - $CH_3-CH_2-CH_2-CH_2-Cl$ (I) and $CH_3-\underset{\substack{| \\ CH_3}}{CH}-CH_2-Cl$ (II)
 - $CH_3-CH_2-CH_2-Cl$ (I) and $CH_3-CH_2-CH_2-Br$ (II)
 - $CH_3-\underset{\substack{| \\ CH_3}}{CH}-CH_2-CH_2-Cl$ (I) and $CH_3-\overset{\substack{CH_3 \\ |}}{C}-CH_2Cl$ (II)
 - $CH_3-CH_2-CH_2-\underset{\substack{| \\ Br}}{CH}-CH_3$ (I) and $CH_3-\overset{\substack{CH_3 \\ |}}{CH}-CH_2-\underset{\substack{| \\ Br}}{CH}-CH_3$ (II)

6. Of the following statements which are true for S_N1 reaction.
- Tertiary alkyl halides react faster than secondary.
 - The absolute configuration of the product is opposite to that of the reactant when an optical active substrate is used.
 - The reaction shows first order kinetics.
 - The rate of reaction depends markedly on the nucleophilicity of the nucleophile.
 - The mechanism is two step.
 - Carbocations are intermediate.
 - Rate \propto [Alkyl halides]
 - The rate of the reaction depends on the nature of the leaving group.

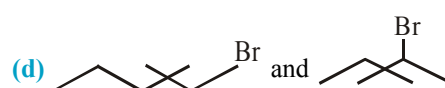
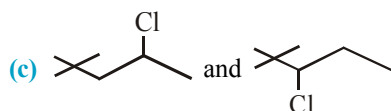
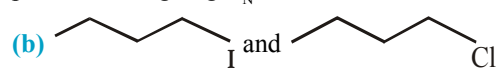
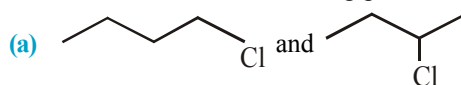


- (a) Br_2/Fe (b) Br_2/CCl_4 (c) NBS (d) HBr

8. Identify major product in the following : $ClCH_2CHCl_2 \xrightarrow{OH^-} CH_2=CCl_2$

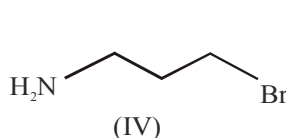
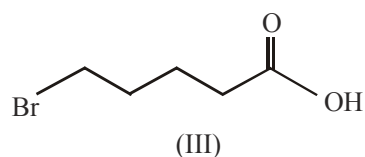
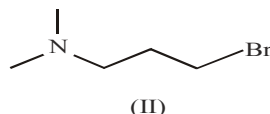
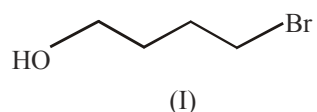


9. Which is faster in the following pairs of halogen compounds undergoing S_N2 reactions?



10. R - Mg - Br (A) on reaction with H_2O forms a gas (B), which occupied 1.4 L/g at NTP. What is product when R - Br reacts with benzene in presence of $AlCl_3$?

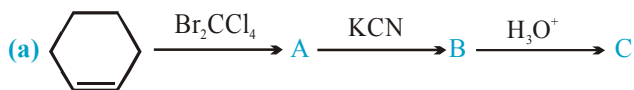
11. Which of the following alkyl halide could be successfully used to synthesize Grignard reagent and why other fail?



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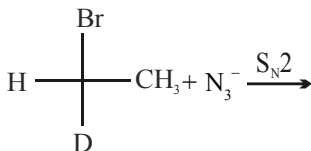
12. An alkyl bromide A has molecular formula $C_8H_{17}Br$ and four different structures can be drawn for it, all optically active. A on refluxing with ethanolic KOH solution yields only one elimination product B (C_8H_{16}) which is still enantiomeric. B on treatment with H_2/Pt yields C (C_8H_{18}) which does not rotate the plane polarized light, B on ozonolysis followed by work-up with H_2O_2 yields D ($C_7H_{14}O$) as one product which is still resolvable. Deduce structures of A to D.

13. Identify A to G in the following.



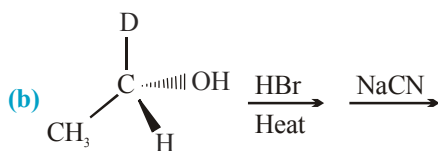
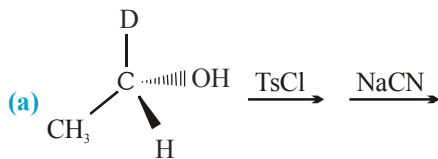
14. Explain the following observations:

- (a) Azide ion (N_3^-) react with 2-bromopentane thousand times faster than with neopentyl bromide in a S_N2 reaction though former is a secondary halide while latter is primary.
- (b) What will happen to the stereochemistry of product of the following reaction:

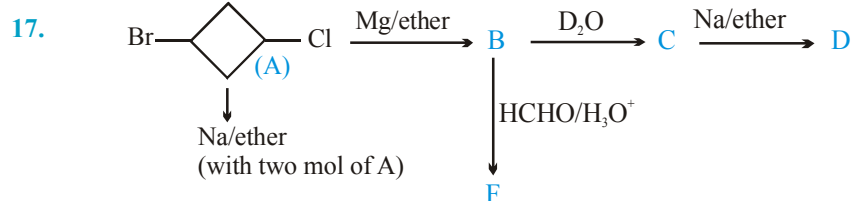
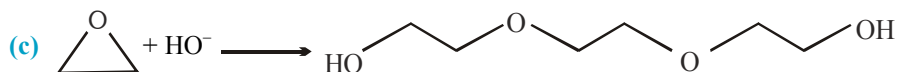
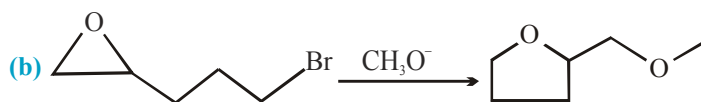


- (c) What will happen to the rate if the concentration of alkyl bromide in (b) is doubled?
- (d) What will happen to the rate if the concentration of azide ion in (b) is doubled?
- (e) How the sign of optical rotation of reactant and product are related in (b)
- (f) When allowed to stand in dilute H_2SO_4 , laevo-rotatory 2-butanol slowly loses optical activity.

15. Provide structure of major product in the following reaction indicating stereochemistry where appropriate:



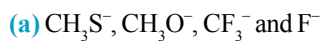
16. Propose mechanism of the following reactions:



Identify B to F

18. Vinyl chloride does not give S_N reaction but allyl chloride gives. Explain.

19. Arrange the following in the increasing order of their ability as a leaving group:

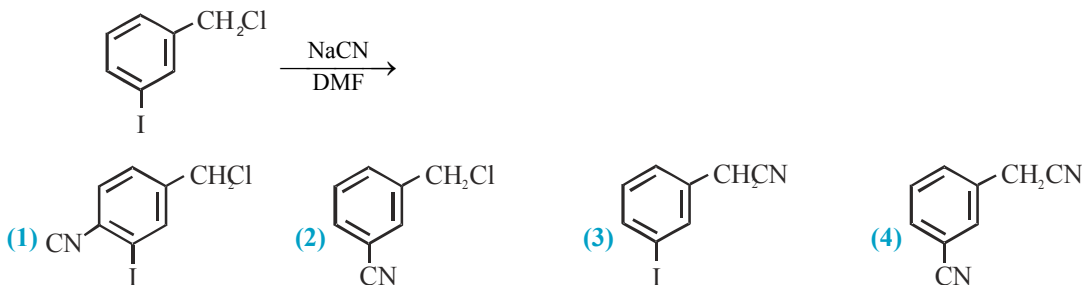


20. RBr when treated with AgCN in a highly polar solvent gives RNC whereas when it is treated with NaCN it gives RCN . Explain.

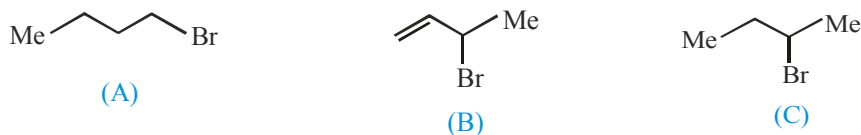
Exercise # 5

Part # I [Previous Year Questions] [AIEEE/JEE-MAIN]

- Tertiary alkyl halides are practically inert to substitution by S_N2 mechanism because of : [AIEEE-2005]
 (1) steric hindrance (2) inductive effect (3) instability (4) insolubility
- Reaction of trans 2-phenyl-1-bromocyclopentane on reaction with alcoholic KOH produces: [AIEEE-2006]
 (1) 2-phenylcyclopentene (2) 1-phenylcyclopentene
 (3) 3-phenylcyclopentene (4) 4-phenylcyclopentene
- The structure of the major product formed in the following reaction is : [AIEEE-2006]

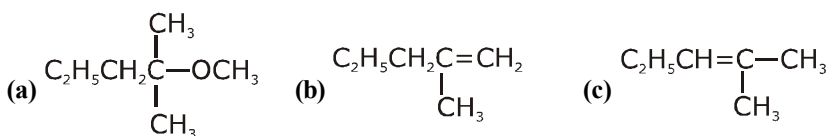


- Which of the following is the correct order of decreasing S_N2 reactivity ? [AIEEE-2007]
 (1) $RCH_2X > R_3CX > R_2CHX$ (2) $RCH_2X > R_2CHX > R_3CX$
 (3) $R_3CX > R_2CHX > RCH_2X$ (4) $R_2CHX > R_3CX > RCH_2X$
- Consider the following bromides : [AIEEE-2010]



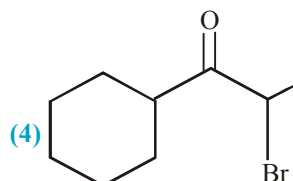
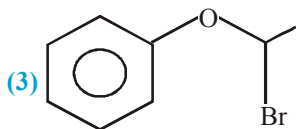
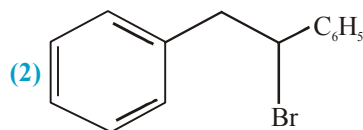
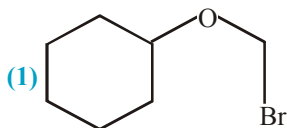
The correct, order of S_N1 reactivity is

- (1) $B > C > A$ (2) $B > A > C$ (3) $C > B > A$ (4) $A > B > C$
- What is DDT among the following : [AIEEE-2012]
 (1) Greenhouse gas (2) A fertilizer
 (3) Biodegradable pollutant (4) Non-biodegradable pollutant
- 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 : [JEE MAINS 2013]
 (1) carbanion (2) carbene (3) carbocation (4) free radical
- 2-chloro-2-methylpentane on reaction with sodium methoxide in methanol yields : [JEE MAINS 2016]



- (1) (a) and (c) (2) (c) only (3) (a) and (b) (4) All of these

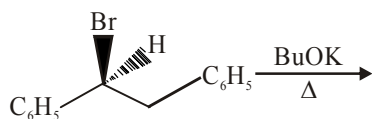
9. Which of the following, upon treatment with tert-BuONa followed by addition of bromine water, fails to decolourize the colour of bromine ? [JEE MAINS 2017]



10. 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 MAINS 2017]

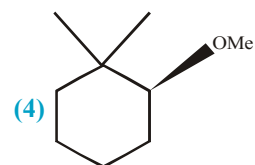
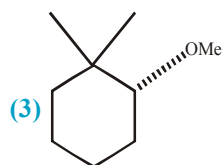
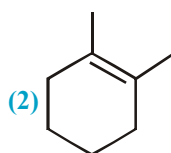
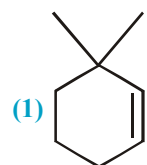
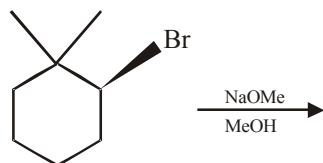
- (1) Six (2) Zero (3) Two (4) Four

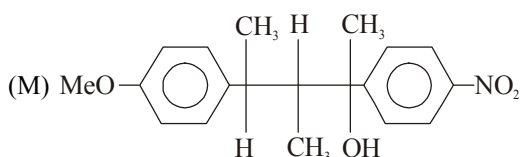
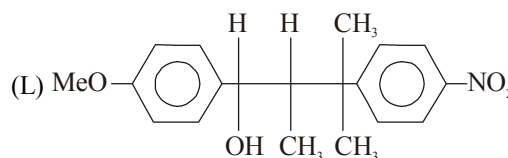
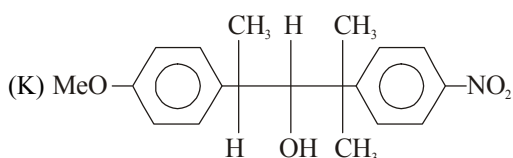
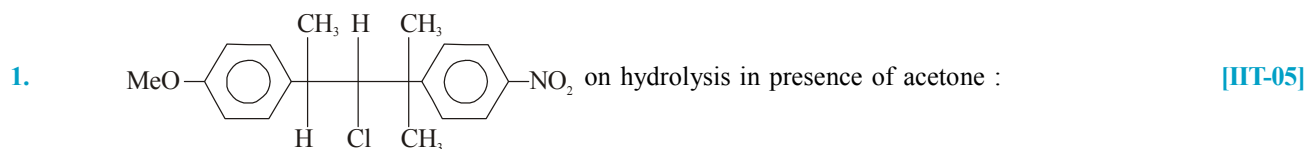
11. The major product obtained in the following reaction is : [JEE MAINS 2017]



- (1) $(\pm) \text{C}_6\text{H}_5\text{CH}(\text{O}^t\text{Bu})\text{CH}_2\text{C}_6\text{H}_5$ (2) $\text{C}_6\text{H}_5\text{CH}=\text{CHC}_6\text{H}_5$
 (3) $(+) \text{C}_6\text{H}_5\text{CH}(\text{O}^t\text{Bu})\text{C}_2\text{H}_5$ (4) $(-) \text{C}_6\text{H}_5\text{CH}(\text{O}^t\text{Bu})\text{CH}_2\text{C}_6\text{H}_5$

12. The major product of the following reaction is : [JEE MAINS 2018]





(A) K & L

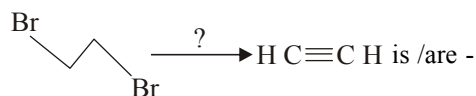
(B) only L

(C) M only

(D) K & M

2. The reagent (s) for the following conversion :

[IIT-07]



(A) alcoholic KOH

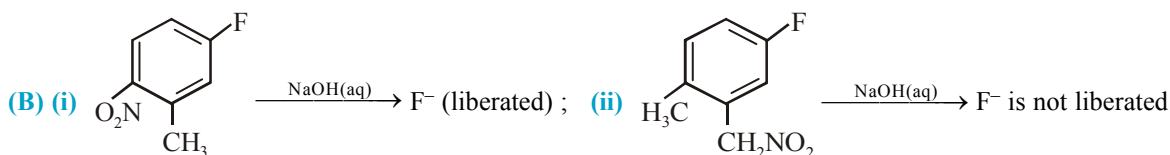
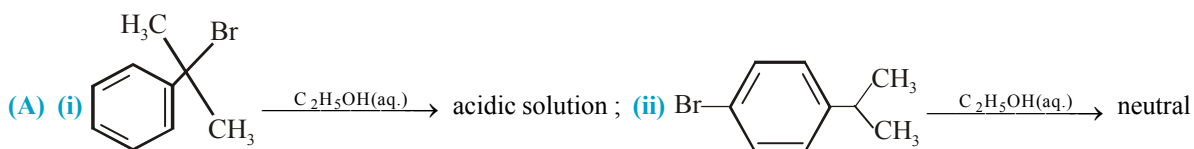
(B) Alcoholic KOH followed by NaNH₂

(C) aqueous KOH followed by NaNH₂

(D) Zn/CH₃OH

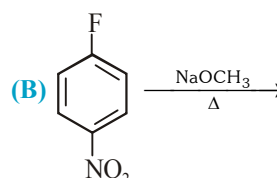
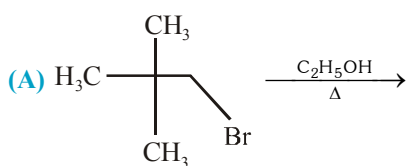
3. Give reasons :

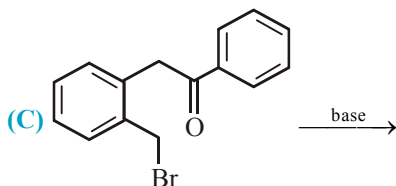
[IIT 2005]



4. An alkyl halide, (A) of formula C₆H₁₁Cl on treatment with potassium tertiary butoxide gives two isomeric alkenes (B) and (C) C₆H₁₀. Both alkene on hydrogenation give methylcyclopentane. Predict the structure of (A), (B) and (C).

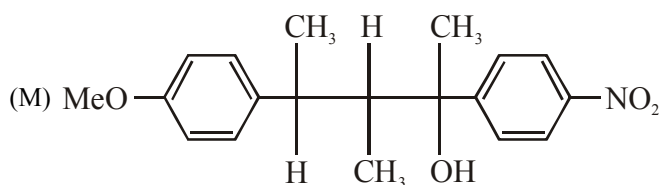
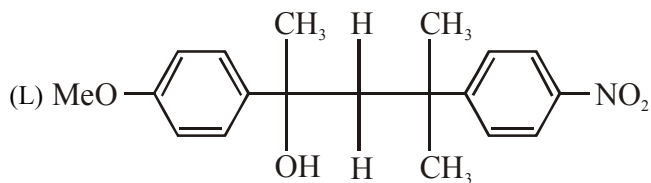
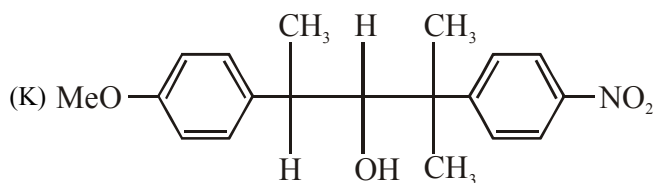
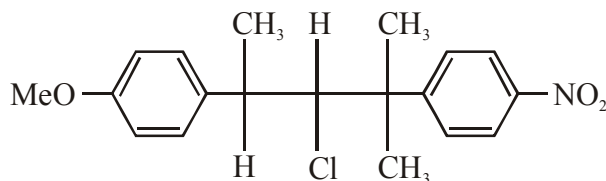
5. Which would be the major product in each of the following reactions ?





6. The following compound on hydrolysis in aqueous acetone will give:

[IIT 2005]



It mainly gives

(A) K and L

(B) Only K

(C) L and M

(D) Only M

7. Match the following:

[IIT 2006]

Column I

(A) $\text{CH}_3\text{-CHBr-CD}_3$ on treatment with alc. KOH gives $\text{CH}_2=\text{CH-CD}_3$ as a major product.

(B) Ph-CHBr-CH_3 reacts faster than Ph-CHBr-CD_3 .

(C) $\text{Ph-CD}_2\text{-CH}_2\text{Br}$ on treatment with $\text{C}_2\text{H}_5\text{OD/C}_2\text{H}_5\text{O}^-$ gives Ph-CD=CH_2 as the major product.

(D) $\text{PhCH}_2\text{CH}_2\text{Br}$ and $\text{PhCD}_2\text{CH}_2\text{Br}$ react with same rate.

Column II

(P) E1 reaction

(Q) E2 reaction

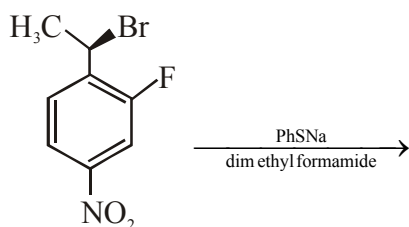
(R) E1cb reaction

(S) First order reaction

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8. The major product of the following reaction is

[IIT 2008]



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

9. In the reaction $\xrightarrow{\text{HBr}}$ the products are

[IIT 2010]

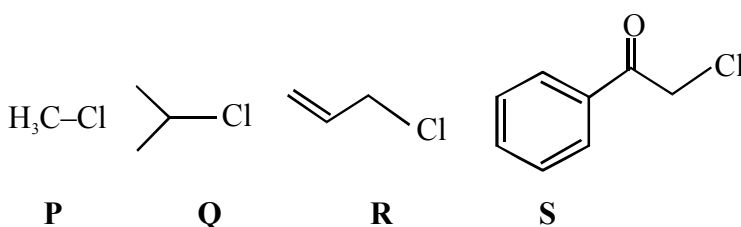
- (A) (B) (C) (D)

10. The total number of alkenes possible by dehydrobromination of 3-bromo-3-cyclopentylhexane using alcoholic KOH is

[IIT-2011]

11. KI in acetone, undergoes S_N2 reaction with each of P, Q, R and S. The rates of the reaction vary as -

[IIT 2013]

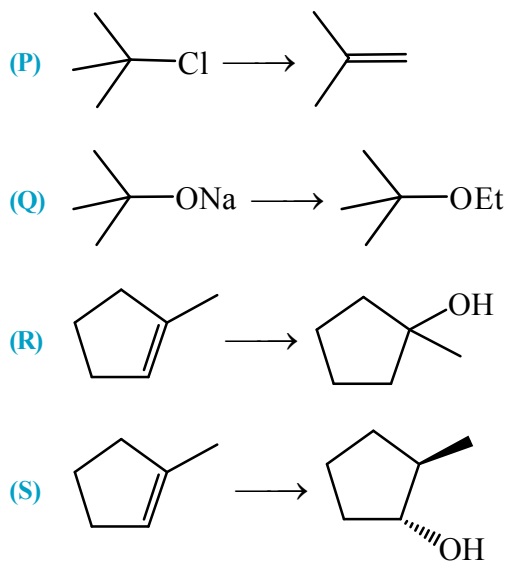


- (A) $P > Q > R > S$ (B) $S > P > R > Q$ (C) $P > R > Q > S$ (D) $R > P > S > Q$

12. Match the chemical conversions in List-I with the appropriate reagents in List-II and select the correct answer using the code given below this lists -

[IIT 2013]

List-I



List-II

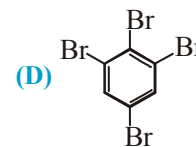
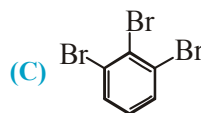
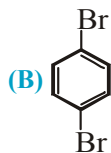
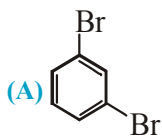
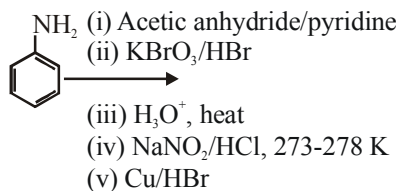
- (1) (i) $\text{Hg}(\text{OAc})_2$ (ii) NaBH_4
- (2) NaOEt
- (3) Et-Br
- (4) (i) BH_3 (ii) $\text{H}_2\text{O}_2/\text{NaOH}$

Codes :

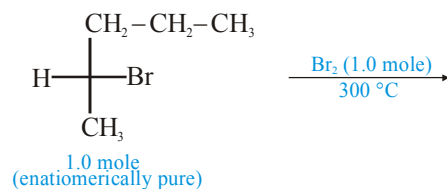
	P	Q	R	S
(A)	2	3	1	4
(B)	3	2	1	4
(C)	2	3	4	1
(D)	3	2	4	1

13. The product (s) of the following reaction sequence is (are) :

[JEE (Advanced) 2016]

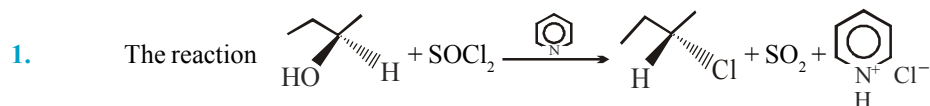


14. In the following monobromination reaction, the number of possible chiral products is : [JEE (Advanced) 2016]



MOCK TEST

SECTION - I : STRAIGHT OBJECTIVE TYPE



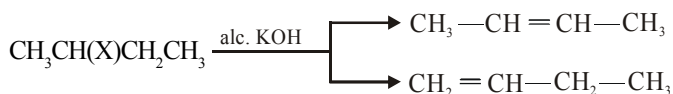
proceeds by the mechanism

- (A) S_N1 (B) S_N2 (C) S_Ni (D) S_E2

2. The products of reaction of alcoholic silver nitrite with ethyl bromide are

- (A) Ethane (B) Ethene (C) Ethyl alcohol (D) Nitro ethane

3. For the reaction



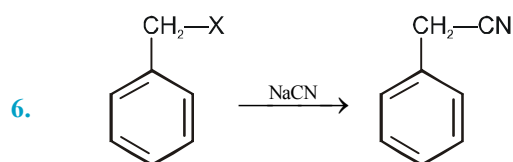
- (A) $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$ predominates (B) $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_3$ predominates
(C) Both are formed in equal amounts (D) The product ratio depends on the halogen

4. Identify 'Z' in the following reaction series, $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \xrightarrow{\text{aq. NaOH}} (\text{X}) \xrightarrow[\text{Heat}]{\text{Al}_2\text{O}_3} (\text{Y}) \xrightarrow{\text{HOCl}} (\text{Z})$:

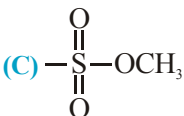
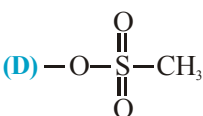
- (A) Mixture of $\text{CH}_3\text{CH}(\text{Cl})-\text{CH}_2$ and $\text{CH}_3\text{CH}(\text{OH})-\text{CH}_2$ (B) $\text{CH}_3-\text{CH}(\text{OH})-\text{CH}_2\text{Cl}$
(C) $\text{CH}_3-\text{CH}(\text{Cl})-\text{CH}_2\text{OH}$ (D) $\text{CH}_3-\text{CH}(\text{Cl})-\text{CH}_2\text{Cl}$

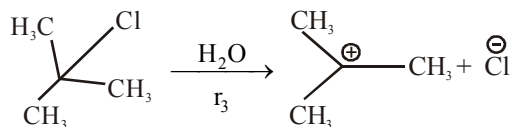
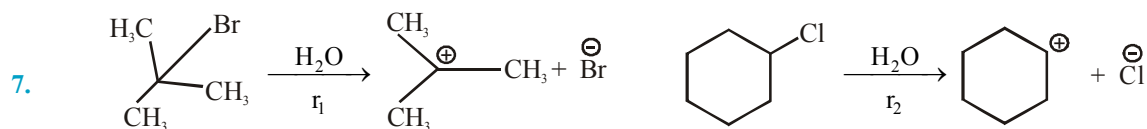
5. Ethyl alcohol reacts at a faster rate with HI than with HCl in forming the corresponding ethyl halides under identical conditions mainly because -

- (A) HI, being a stronger acid, protonates ethyl alcohol at oxygen much better and helps substitution
(B) the bond length in HI is much shorter than that in HCl
(C) I^- is a much better leaving group
(D) I^- is a much better nucleophile than Cl^-



In the given reaction rate is fastest, when (X) is :

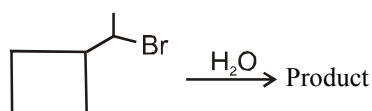
- (A) $-\text{OH}$ (B) $-\text{NH}_2$
(C)  (D) 

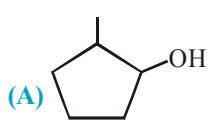
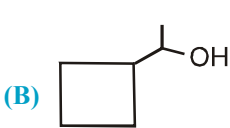
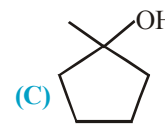



the rates r_1 , r_2 and r_3 are in the order :

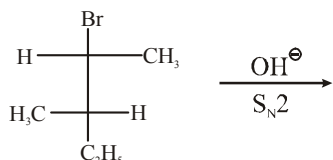
- (A) $r_1 > r_2 > r_3$ (B) $r_3 > r_1 > r_2$ (C) $r_1 > r_3 > r_2$ (D) $r_2 > r_1 > r_3$

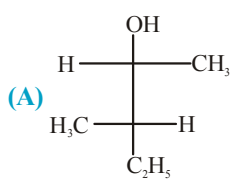
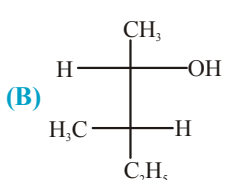
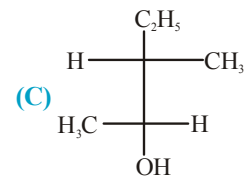
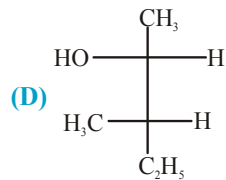
8. What will be the major product of the following reaction



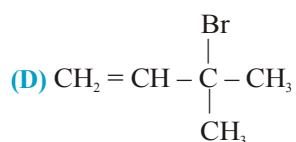
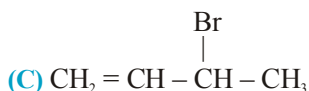
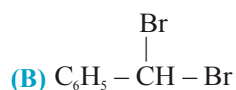
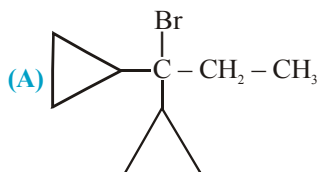
- (A)  (B)  (C)  (D) 

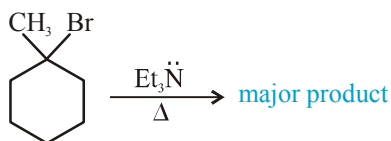
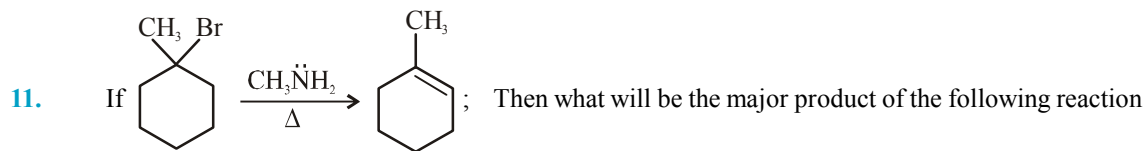
9. In the following reaction the most probable product will be :



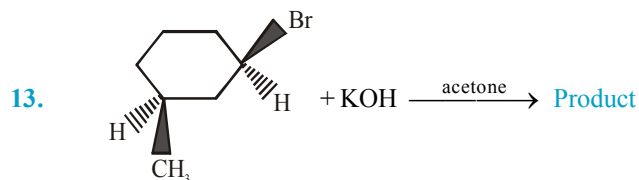
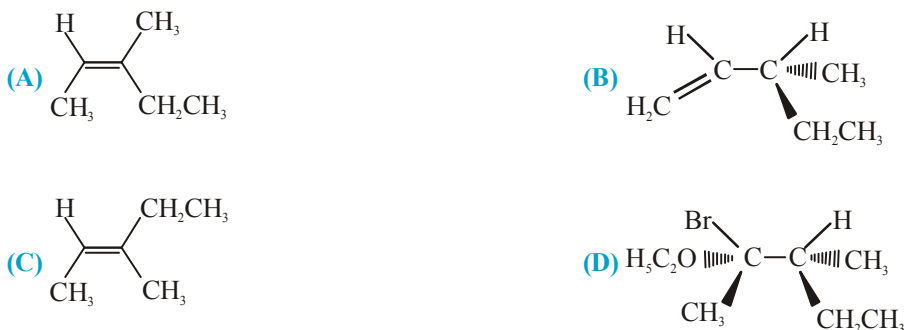
- (A)  (B)  (C)  (D) 

10. Which of the following will be most reactive for E1 reaction ?





12. Select the formula representing the major product of the following reaction

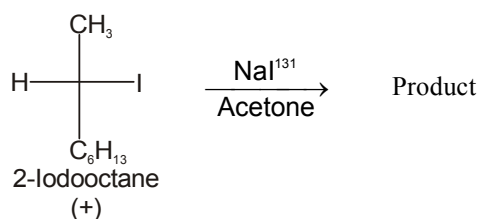


(1R, 3S)-Cis-1-Bromo-3-methylcyclohexane.

The product formed in the reaction is



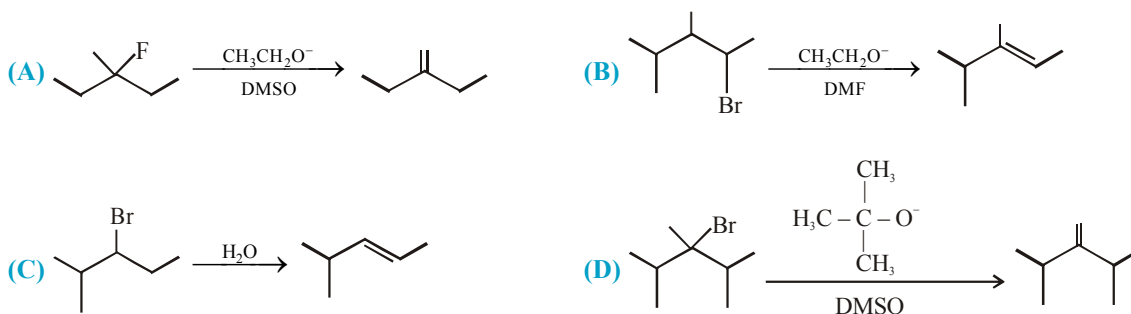
14. Which statement is incorrect about the following reaction



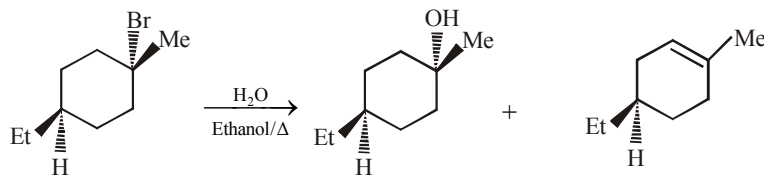
- (A) The rate of these reaction depends on both $[\text{R-I}]$ and $[\text{}^{131}\text{I}^\ominus]$
 (B) Loss of optical activity was twice as fast as gain of radioactivity.
 (C) Each molecule undergoing substitution, suffers Inversion of configuration
 (D) Final solution has radioactive iodine only

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

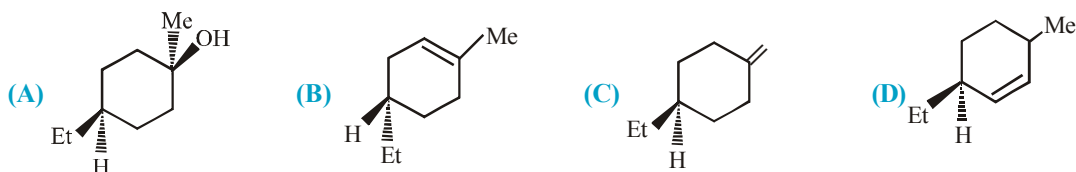
15. Which of the following does/do produce a white precipitate of AgCl on warming with alcoholic silver nitrate?
 (A) Allyl chloride (B) t-Butyl chloride (C) Benzyl chloride (D) Vinyl chloride
16. Which of the following are aprotic solvents :
 (A) DMSO (B) DMF (C) H_2O (D) CH_3COOH
17. Which of the following reagents can be used to prepare an alkyl halide :-
 (A) NaCl (B) $\text{HCl} + \text{ZnCl}_2$ (C) SOCl_2 (D) PCl_5
18. Which of the following reactions represent the major product.



19. Consider the following $\text{E1/S}_{\text{N}}1$ reaction :

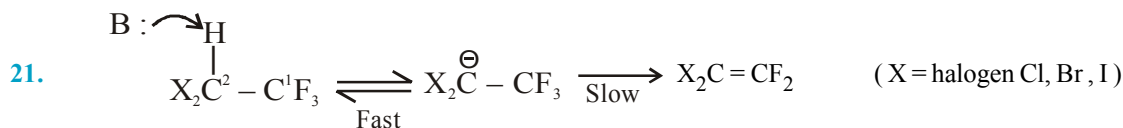
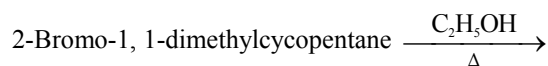


The missing product (s) is (are) :



CHEMISTRY FOR JEE MAIN & ADVANCED

20. Predict the products expected in given reaction



Correct statement (s) is (are)

- (A) X being electronegative, makes the H (on C-2) more acidic.
 (B) Due to electron withdrawal nature of X, it stabilises the carbanion
 (C) (X) destabilises the carbanion due to the presence of lone pairs.
 (D) The reaction proceeds by an E1 cB pathway.

SECTION - III : ASSERTION AND REASON TYPE

These questions contains, Statement-I (assertion) and Statement-II (reason).

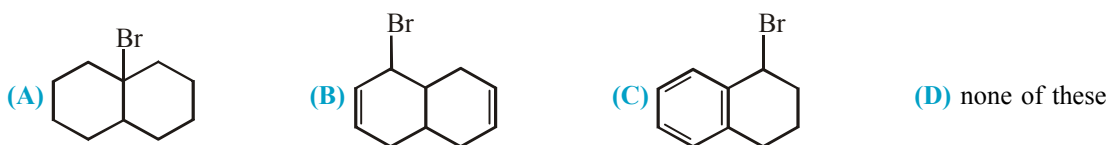
- (A) Statement-I is True, Statement-II is True ; Statement-II is a correct explanation for Statement-I
 (B) Statement-I is True, Statement-II is True ; Statement-II is NOT a correct explanation for Statement-I
 (C) Statement-I is True, Statement-II is False.
 (D) Statement-I is False, Statement-II is True.
22. **Statement-1 :** $\text{S}_{\text{N}}2$ reaction is carried out in the presence of polar aprotic solvents.
Statement-2 : Polar aprotic solvents do not contain acidic hydrogen.
23. **Statement-1 :** Iodide (I^-) is the strongest nucleophile (in protic solvent) among the halide anions
Statement-2 : Iodide is the largest halide anion and is the most weakly solvated in a protic solvent
24. **Statement-I :** Primary benzylic halides are more reactive than primary alkyl halides towards $\text{S}_{\text{N}}1$ reaction.
Statement-II : Reactivity depends upon the nature of the nucleophile and the solvent.
25. **Statement-I :** Vinylic halides are reactive towards nucleophilic substitution reaction.
Statement-II : Reactivity is due to the polarity of carbon-halogen bond.

SECTION - IV : COMPREHENSION TYPE

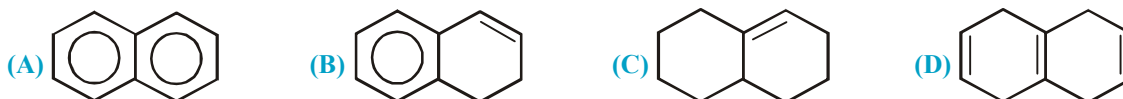
Read the following comprehensions carefully and answer the questions.

An organic compound A has molecular formula $\text{C}_{10}\text{H}_{17}\text{Br}$ and it is non-resolvable. A does not decolourize brown colour of bromine water solution. A on treatment with $(\text{CH}_3)_2\text{COK}/(\text{CH}_3)_3\text{COH}$ yields B as major product. B on treatment with H_2/Pt yields $(\text{C}_{10}\text{H}_{16})$ which on treatment with $\text{Cl}_2/h\nu$ yields three monochloro derivative. Also B on boiling with acidic permanganate solution yields C ($\text{C}_{10}\text{H}_{16}\text{O}_3$). C on heating with sodalime yields D ($\text{C}_9\text{H}_{16}\text{O}$). D on reducing with LiAlH_4 followed by heating the product with concentrated H_2SO_4 yields E (C_9H_{16}) as major product. E on treatment with ozone followed by work-up with $\text{Zn-H}_2\text{O}$ yields 6-Ketoneanal.

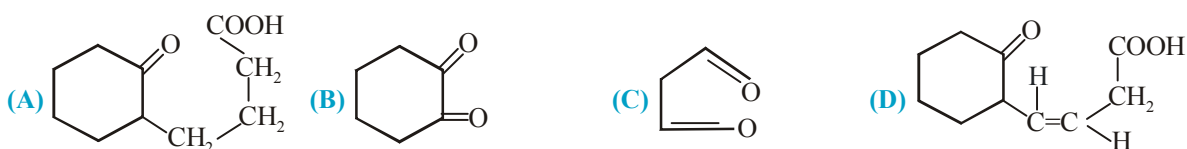
26. Compound A is :



27. Compound B is :



28. Compound C is :



29. Compound D is :

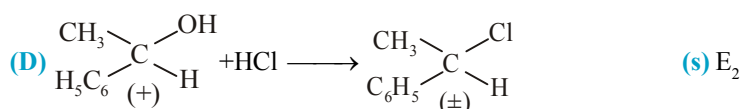
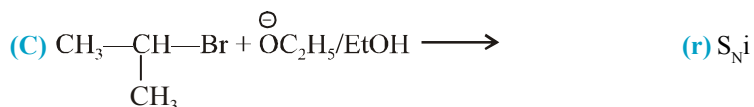
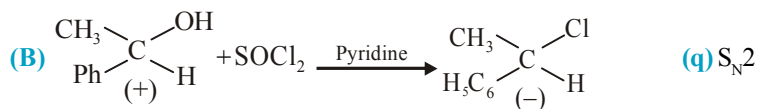
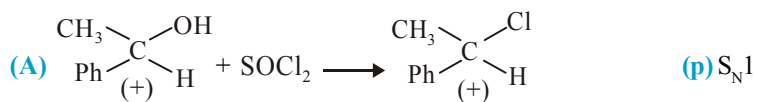


SECTION - V : MATRIX - MATCH TYPE

30. Match the column I with column II.

Column-I (reaction)

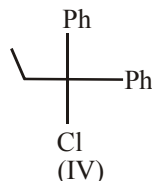
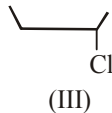
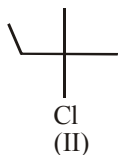
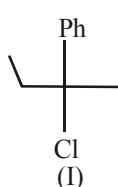
Column-II (Mechanism)



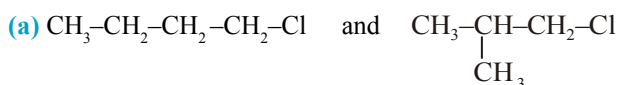
SECTION - VI : SUBJECTIVE TYPE

31. Arrange the following compounds in order of :

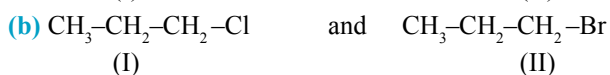
Decreasing S_N1 reaction rate :



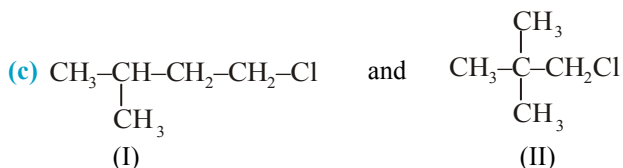
32. Select the member of each pair that shows faster rate of S_N2 reaction with KI in acetone.



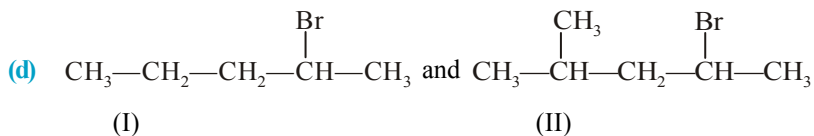
(I) (I) and (II) (II)



(I) (I) and (II) (II)

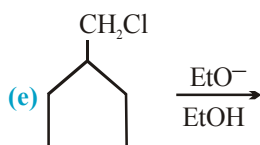
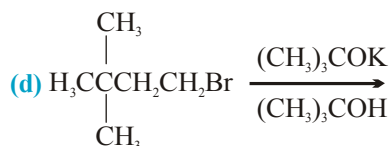
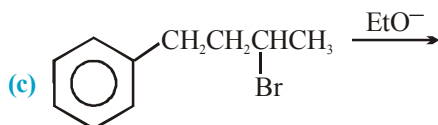
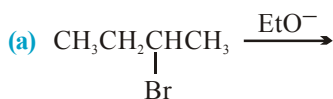


(I) (I) and (II) (II)



(I) (I) and (II) (II)

33. Identify major product in the following : $\text{ClCH}_2\text{CHCl}_2 \xrightarrow{\text{OH}^-} \text{CH}_2=\text{CCl}_2$



34. R-Mg-Br (A) on reaction with H_2O forms a gas (B), which occupied 1.4 L/g at NTP. What is product when R-Br reacts with benzene in presence of AlCl_3 ?

ANSWER KEY
EXERCISE - 1

1. A 2. A 3. C 4. B 5. B 6. B 7. B 8. B 9. C 10. D 11. B 12. C 13. A
 14. C 15. D 16. A 17. C 18. B 19. D 20. B 21. B 22. B 23. B 24. A 25. D 26. D
 27. C 28. C 29. C 30. C 31. B 32. A 33. B 34. D 35. A 36. C 37. A 38. C 39. C
 40. B 41. A 42. B 43. D 44. D 45. C 46. A 47. C 48. A 49. B 50. C 51. B 52. D
 53. B 54. A 55. D

EXERCISE - 2 : PART # I

1. C 2. B 3. B 4. A,B,C 5. C 6. B 7. A,B 8. A,B,C,D 9. B 10. D 11. D
 12. C 13. D 14. A 15. D 16. B,C 17. B,C,D 18. A,C,D 19. B,C 20. A,B
 21. A,B,D 22. B,D 23. C,D 24. A,B,C 25. B,C 26. A,D 27. A,C 28. A,B,C 29. B,C
 30. A,B,C,D 31. A,B 32. A,B,D

PART # II

1. C 2. D 3. B 4. A 5. B 6. D 7. C 8. D 9. B 10. C 11. A 12. A 13. A
 14. B

EXERCISE - 3 : PART # I

1. $A \rightarrow q, B \rightarrow r, C \rightarrow s, D \rightarrow p$
 2. $A \rightarrow r, B \rightarrow q, C \rightarrow s, D \rightarrow p$
 3. $A \rightarrow q, B \rightarrow s, C \rightarrow r, D \rightarrow p$

PART # II

- Comprehension #1:** 1. In the compound at least one hydrogen on the α - carbon is necessary for α - elimination
 2. Tert.butyl bromide is undergo β -elimination most readily due to formation of most stable alkene.
 3. A

Comprehension #2: 1. A 2. A 3. C

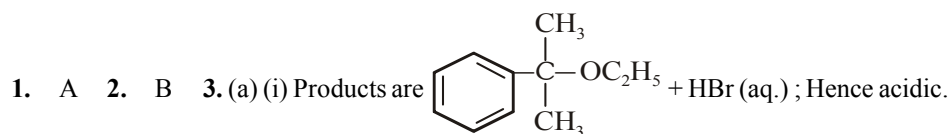
Comprehension #3: 1. C 2. D 3. B 4. B

Comprehension #4: 1. A 2. C 3. A 4. C

EXERCISE - 5 : PART # I

1. 1 2. 3 3. 3 4. 2 5. 1 6. 4 7. 3 8. 4 9. 1 10. 4 11. 2 12. 1

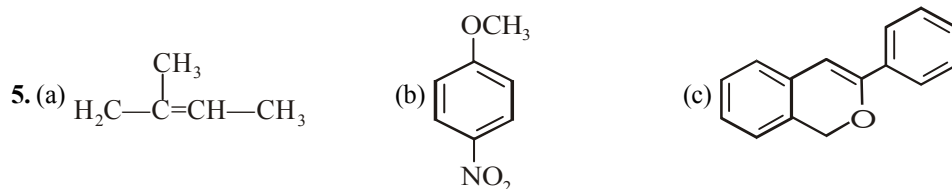
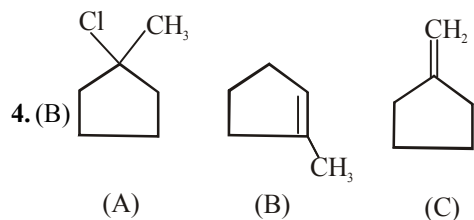
PART # II



(ii) No reaction takes place, as aryl halide is inert to nucleophilic substitution.

(b) (i) —NO₂ group facilitates the nucleophilic attack because it stabilised the anion formed when attack of $\bar{\text{O}}\text{H}$ takes place.

(ii) Does not show reaction.



6. A,C 7. D 8. C 9. D 10. A 11. B 12. A 13. B 14. 5

MOCK-TEST

1. B 2. D 3. D 4. B 5. D 6. D 7. C 8. C 9. B 10. A 11. B 12. C 13. C
 14. D 15. A,B,C 16. A,B 17. B,C,D 18. A,B,D 19. A,B,C 20. A,B,C,D 21. A,B,D 22. B
 23. A 24. B 25. D 26. A 27. C 28. A 29. C 30. A → (r), B → (q), C → (s), D → (p)

