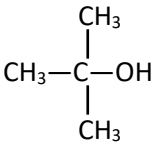
Alcohols and Ethers

SOLUTIONS

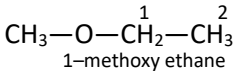
EXERCISE - O

1. **Ans. (D)**

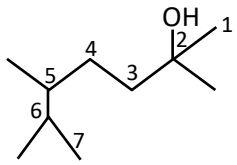


The above molecule represents tertiary alcohol.

2. **Ans. (A)**

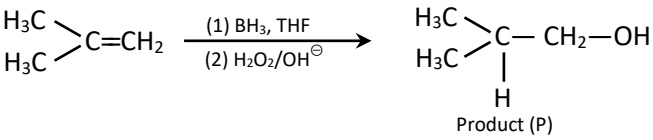


3. **Ans.(D)**



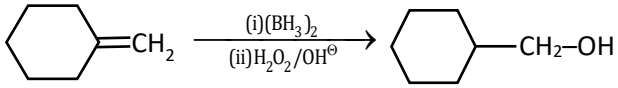
2,5,6–trimethyl–2–

4. **Ans. (A)**



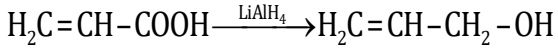
5. **Ans. (D)**

The product formed from the given reaction is :



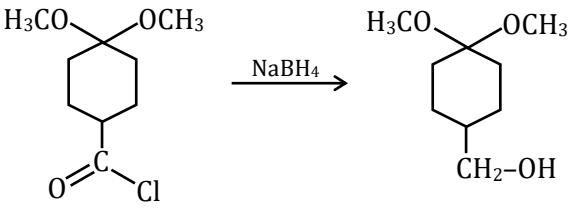
6. **Ans. (C)**

$LiAlH_4$ is a strong reducing agent and will reduce carboxylic acid to alcohol.



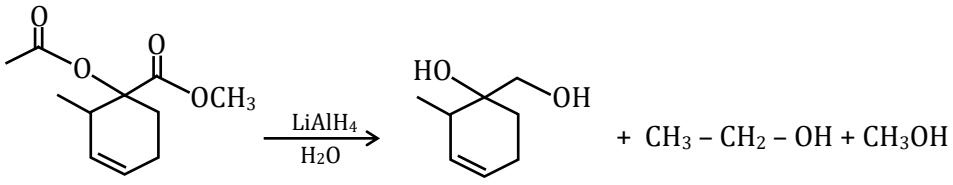
7. **Ans. (C)**

$NaBH_4$ can reduce acyl chloride to alcohol.



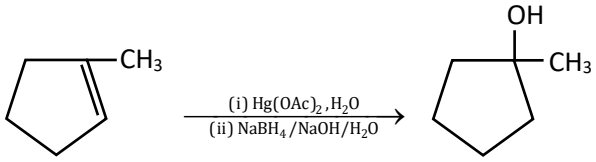
8. Ans. (C)

$LiAlH_4$ is a strong reducing agent. So, it will reduce esters to alcohols.



(A)

9. Ans.(C)



In Oxymercuration Demercuration reaction, addition of $H^{\oplus}$ and $-OH^{\ominus}$ take place according to Markovnikov's rule but without rearrangement.

10. Ans.(A)

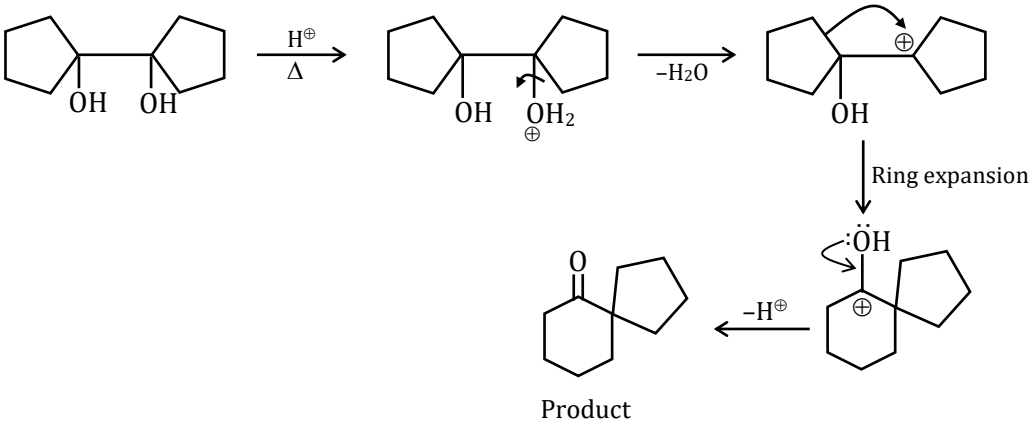
Given reaction is acid catalysed hydration which is an example of electroplic addition reaction.

11. Ans. (D)

Hydroboration does not follow Markovnikov's rule and it is a syn-addition.

12. Ans. (C)

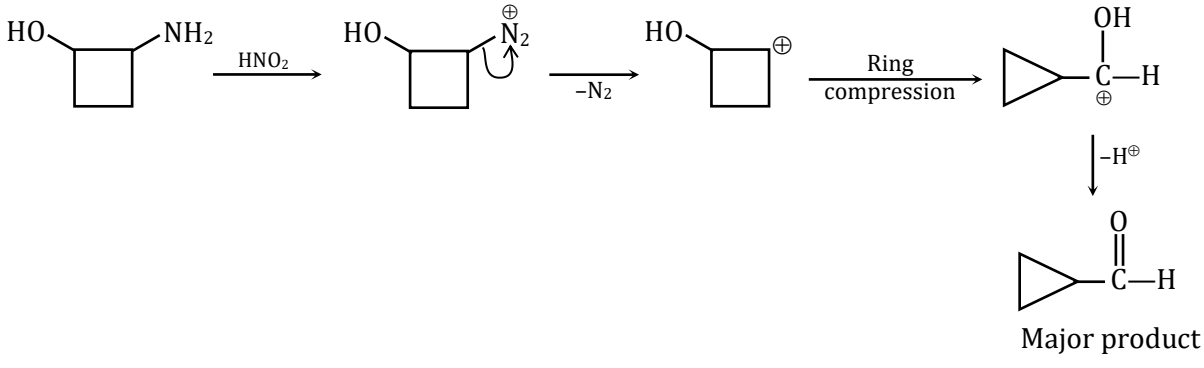
The reaction will occur as :



Product

13. Ans. (C)

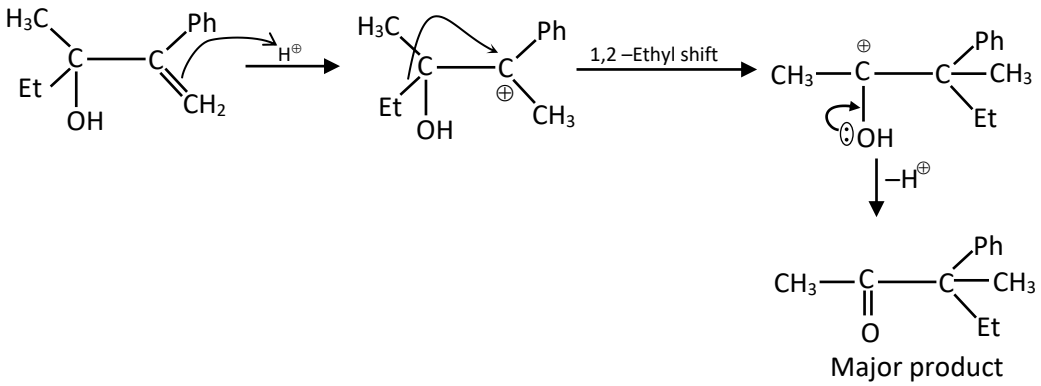
The major product formed is:



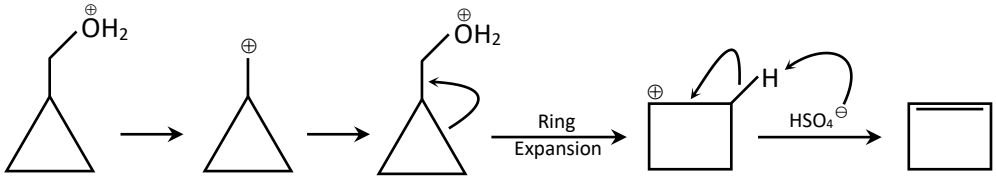
Major product

14. Ans. (B)

The given reaction will proceed as :

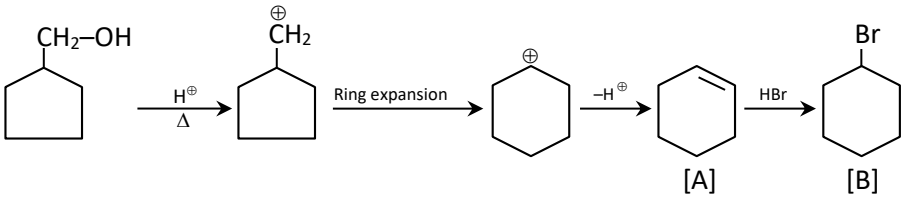


15. Ans. (D)



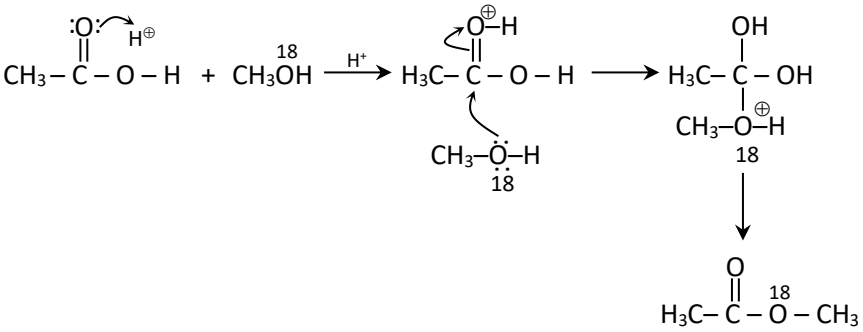
16. Ans. (C)

The product formed in the reaction sequence is :



17. Ans. (D)

The reaction will occur as :



18. Ans. (B)

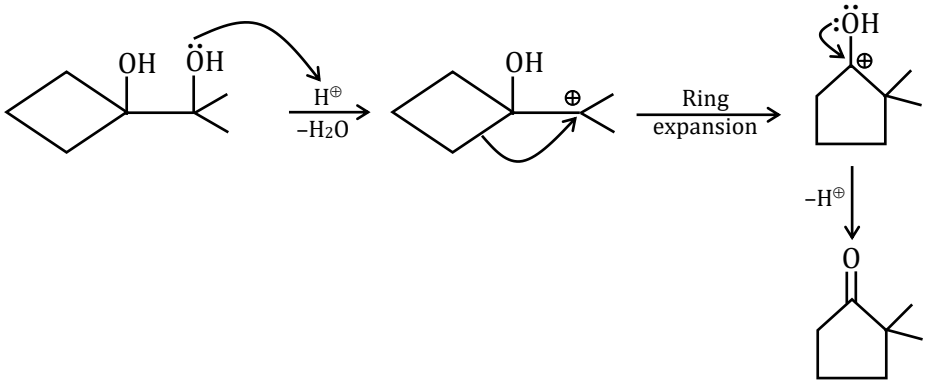
Order of esterification $\propto \frac{1}{\text{Steric crowding}}$

Steric crowding: b > a > c

So, order of esterification will be: c > a > b

19. Ans. (B)

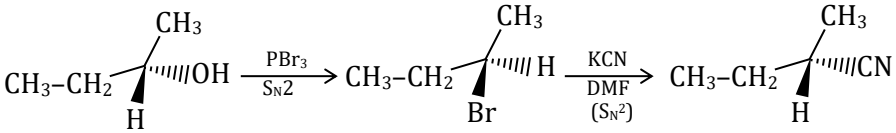
The reaction will occur via mechanism as given below :



Major product

20. Ans. (C)

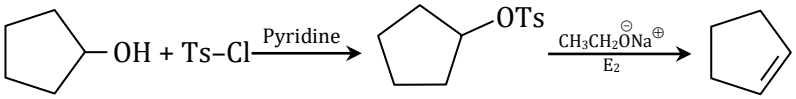
The reaction will be :



Major product

21. Ans. (A)

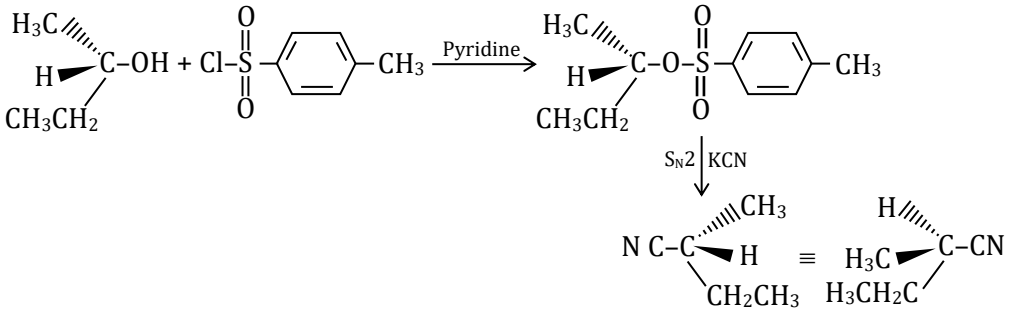
The major product formed will be :



Major product

22. Ans. (C)

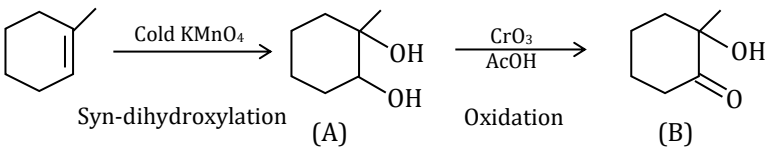
The reaction will proceed as :



Major product

23. Ans. (A)

The complete reaction sequence is :



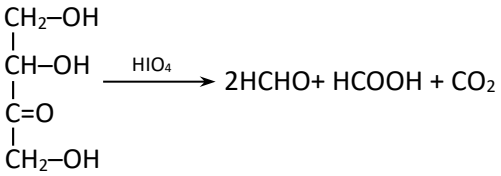
Syn-dihydroxylation (A) Oxidation (B)

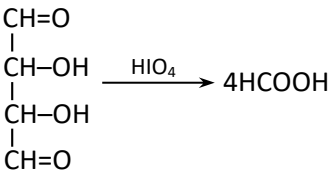
24. Ans. (C)

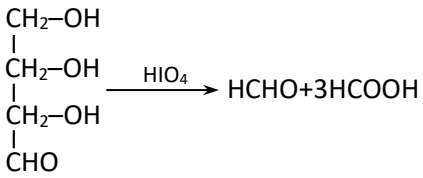
Only vicinal diol / α-hydroxy carbonyl / α,β–dicarbonyol compounds react with HIO_4.

25. Ans. (A)

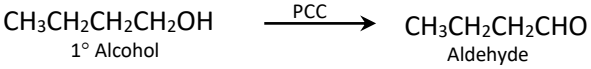
The reactions involved are :

(A) 

(B) 

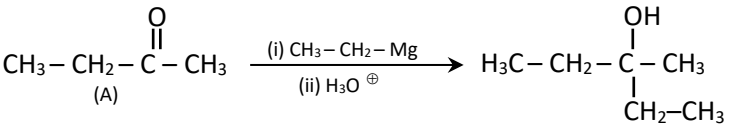
(C) 

26. Ans. (A)



27. Ans. (B)

Tertiary alcohol does not react with PCC. So, the substance will be :

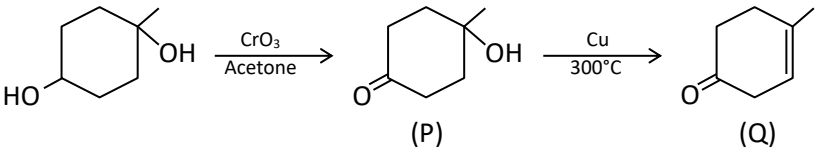


(B)

(Does not react with PCC)

28. Ans. (D)

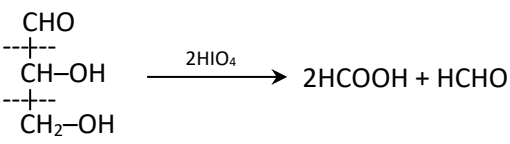
The complete reaction sequence is :



(P) (Q)

29. Ans. (B)

The products formed are:



30. Ans. (C)

3° alcohol does not turn orange colour of chromic acid to green.

31. Ans. (D)

Secondary alcohols give blue colour in Victor Mayer test.

32. Ans. (A)

Primary alcohol gives red colour in victor Meyer test.

33. Ans. (B)

Williamson's ether synthesis reaction involves the treatment of sodium alkoxide with a suitable alkyl halide to form an ether.

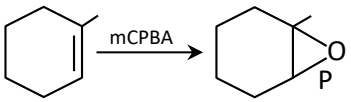
It is Williamson's ether synthesis reaction.

34. Ans. (C)

It does not involve the formation of carbocation, as the reaction involved in S_N2.

35. Ans. (C)

The reaction involved is epoxidation. So, product formed is :



36. Ans. (C)

It involve S_N2 mechanism.

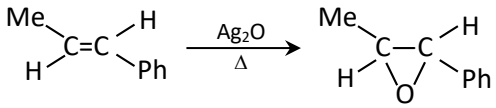
37. Ans. (A)

As it follow S_N2 mechanism, So, $\text{rate} \propto \frac{1}{\text{Steric crowding}}$

Hence, rate of reaction will follow : $CH_3° > 1° > 2° > 3°$

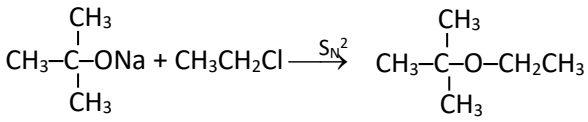
38. Ans. (A)

The product formed is :



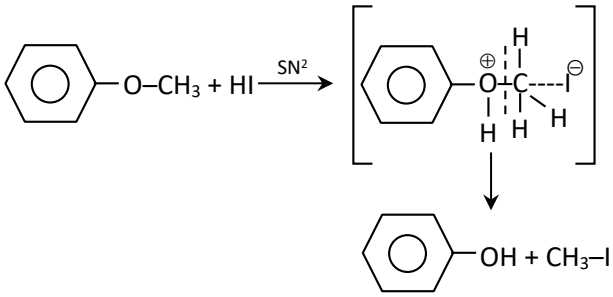
39. Ans. (B)

Only reaction II will give test-butyl ether



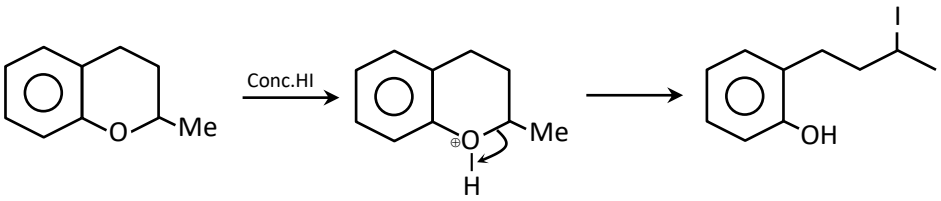
In case of reaction I, these is high steric crowding in alkyl halide. So, elimination takes place in place of substitution

40. Ans.(C)



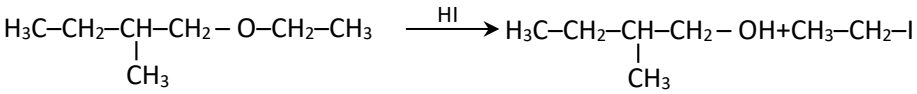
41. Ans. (B)

The product formed is :



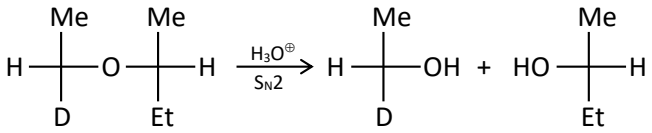
42. Ans. (A)

In S_N2 $I^{\ominus}$ attacks at alkyl group with having less crowding. So, reaction will be,



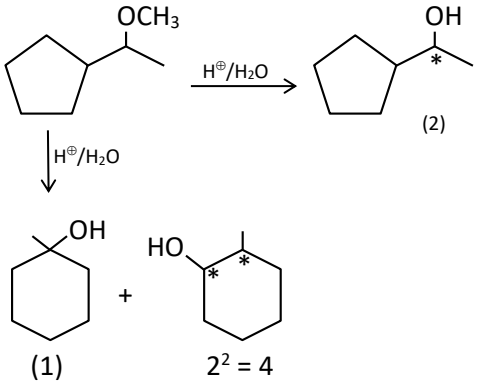
43. Ans. (A)

Acid catalysed cleavase of ether. In this case, the reaction will follow S_N2 mechanism.



44. Ans. (C)

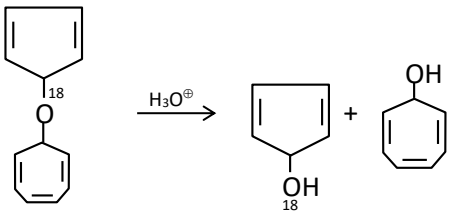
The total number of alcohols formed are :



Total = 2 + 1 + 4 = 7

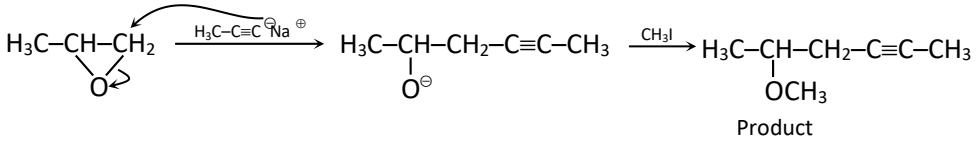
45. Ans. (B)

The products obtained are:



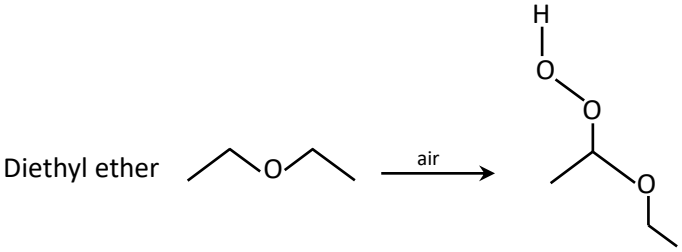
46. Ans. (B)

The reaction obtained is:



Product

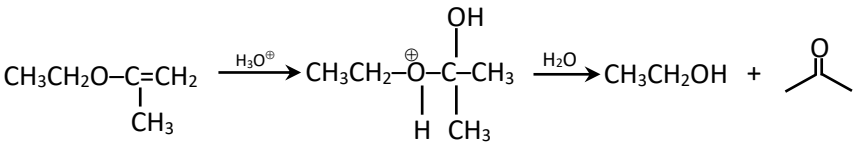
47. Ans. (C)



1–ethoxy–1–hydroperoxyethane

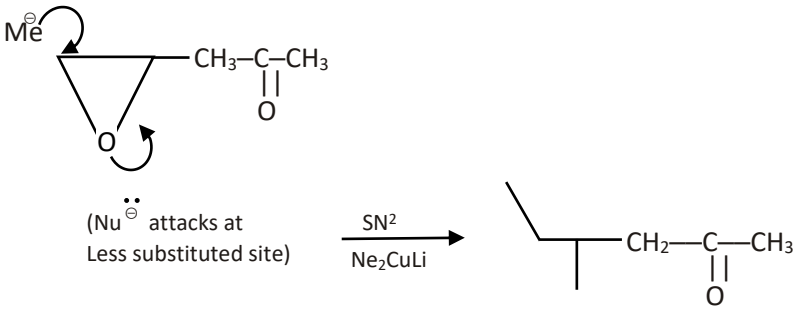
48. Ans. (A)

The reaction involved is :



49. Ans. (A)

Me_2 CuLi is les reactive than Grignard reagent, hence (C = O) group is not reduced.

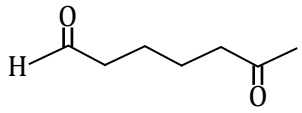


50. Ans. (C,D)

Lucas reagent and $K_2Cr_2O_7$ can differentiate 2° alcohol (A) and 1° alcohol (B).

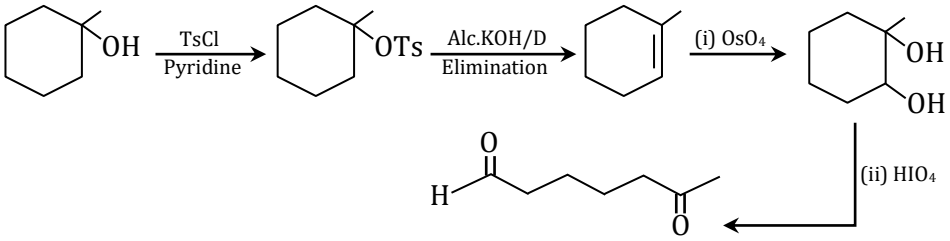
EXERCISE - S

1. Ans.



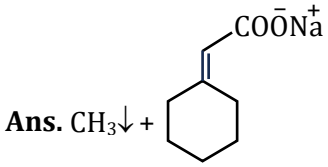
Major product

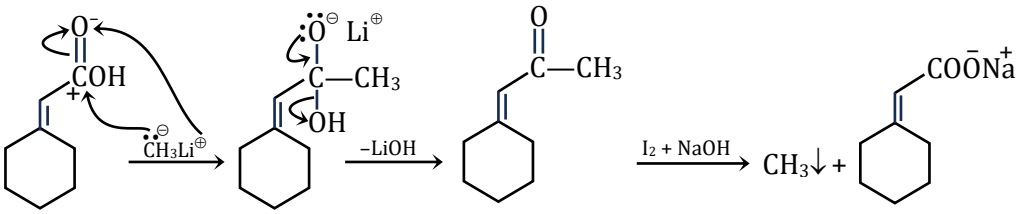
The complete reaction sequence is :



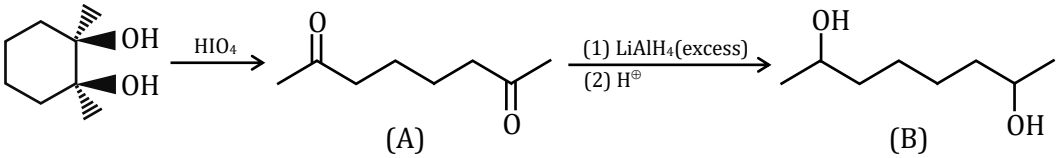
Major product

2. **Ans.** $CH_3\downarrow$ +

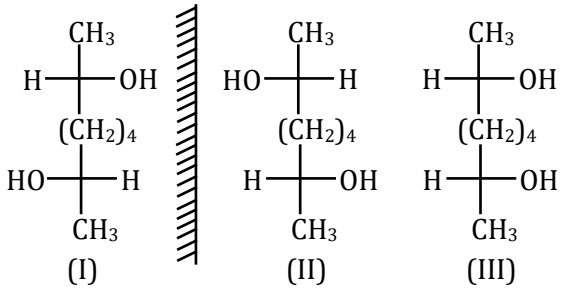




3. **Ans. (3)**

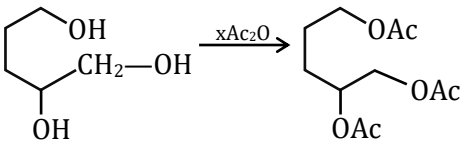


Stereoisomers of (B)



2 chiral centres and plane of symmetry is present in compound (B) so the total stereoisomer of product (B) will be 3 (2 stereoisomers are optically active whereas 1 stereoisomer is optically inactive which is meso form)

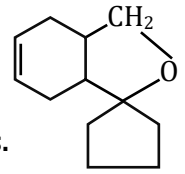
4. **Ans. (3)**



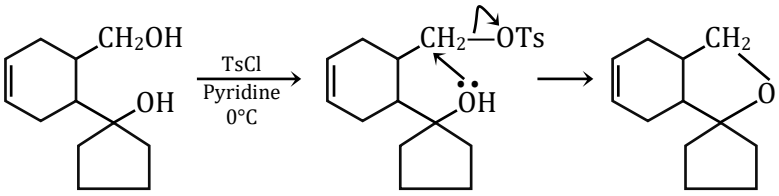
Number of alcohol is number of moles of anhydride consumed.

$\therefore$ 3

5. **Ans.**

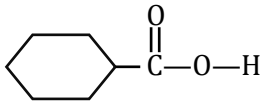


(b)

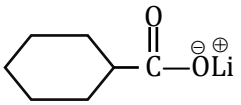


(a) (b)

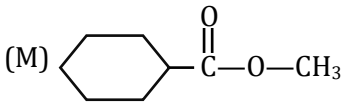
6. **Ans.**



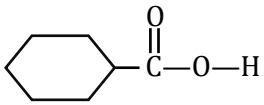
(L)



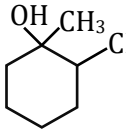
(M)



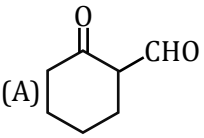
(N)



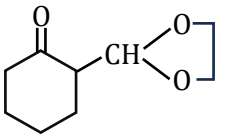
7. **Ans.**



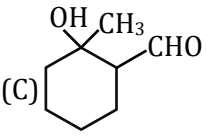
(A)



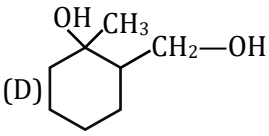
(B)



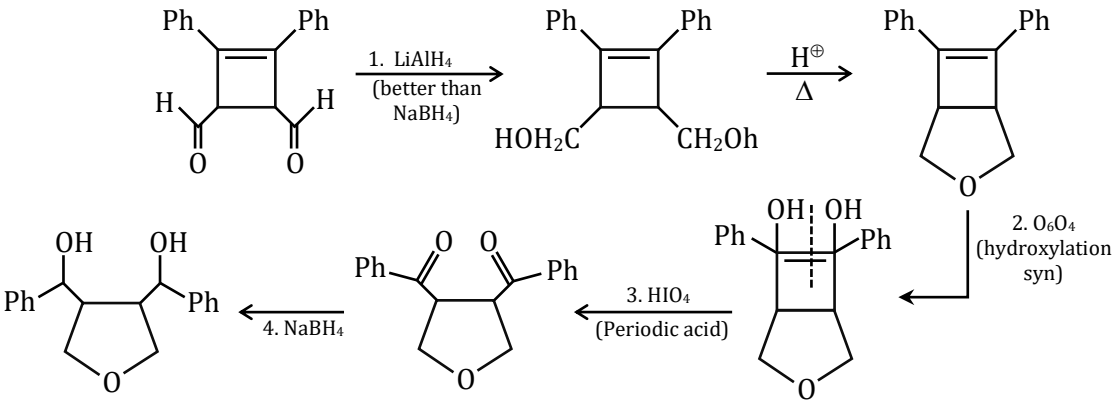
(C)

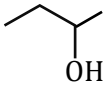


(D)

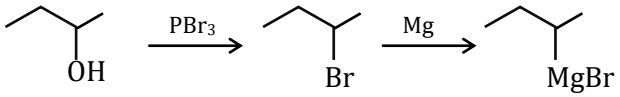


8. **Ans. 1** = $LiAlH_4$, **3** = HIO_4 , **4** = $NaBH_4$

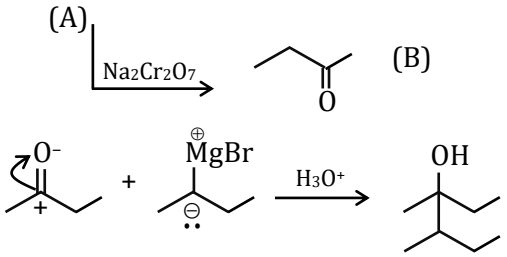


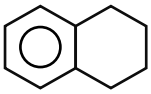
9. **Ans.** 

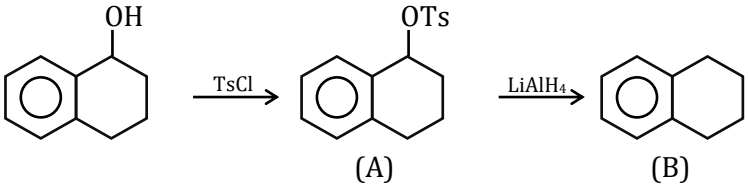
(a)



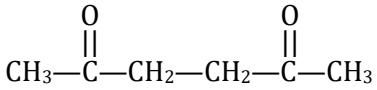
(A) (B)

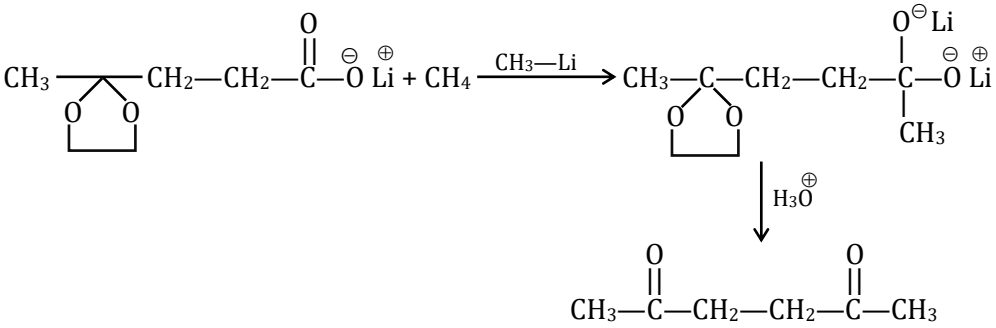


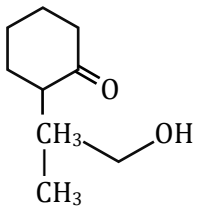
10. **Ans.** 

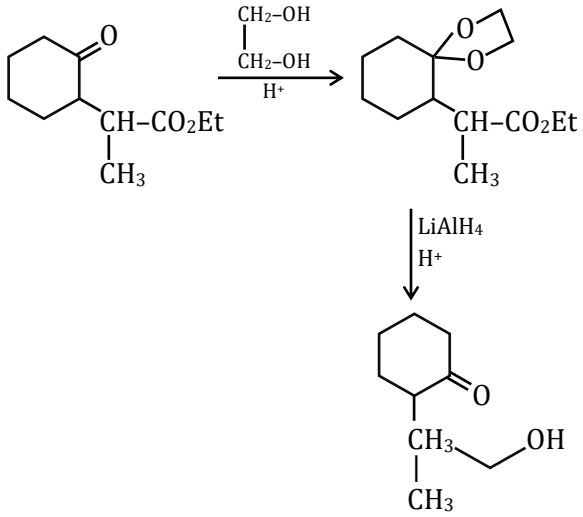


(A) (B)

11. **Ans.** 

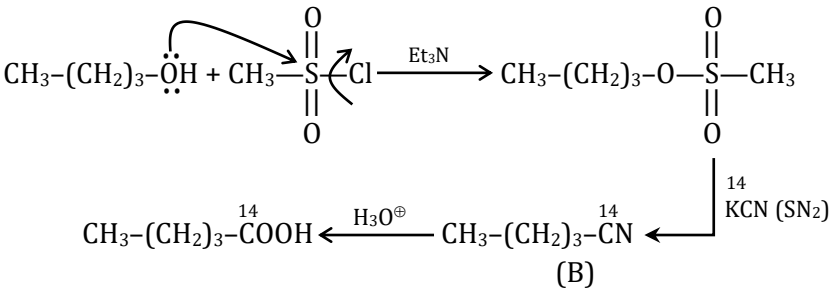


12. **Ans.** 

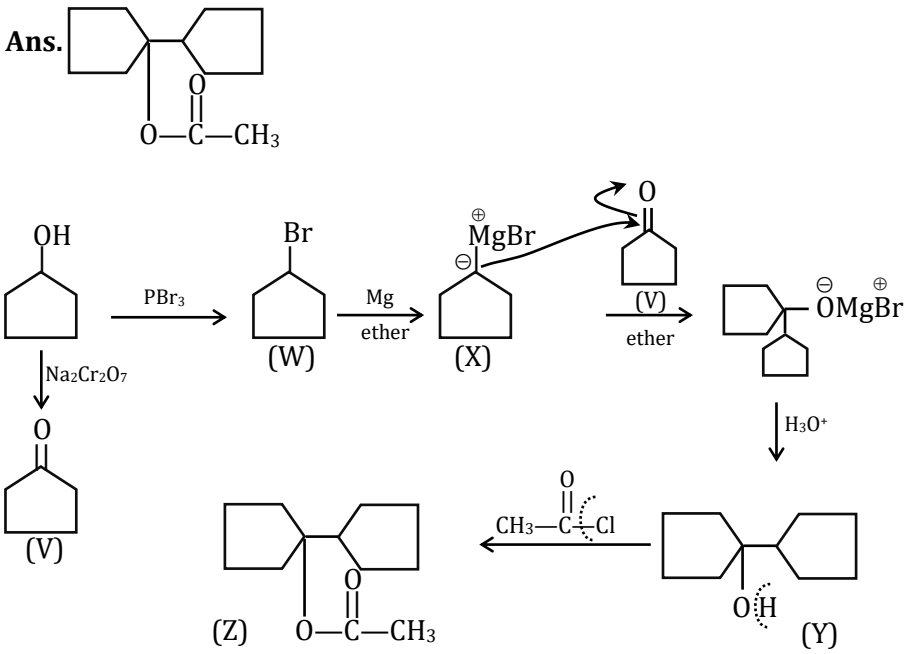


ketone is more reactive than ester toward nucleophilic attack.

13. **Ans.** $CH_3-(CH_2)_3-C^{14}OOH$



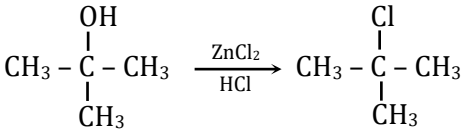
14. **Ans.**



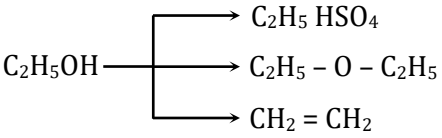
EXERCISE - JEE (Main) PYQ

1. Ans. (3)

3° Alcohol $\xrightarrow[HCl]{ZnCl_2}$ Immediate turbidity



2. Ans. (3)



Acetylene (CH ≡ CH) cannot be formed from above reaction.

3. Ans. (2)

Tertiary alcohol reacts Fastest with Lucas reagent by S_N1 mechanism.

4. Ans. (1)

The reaction involved is :

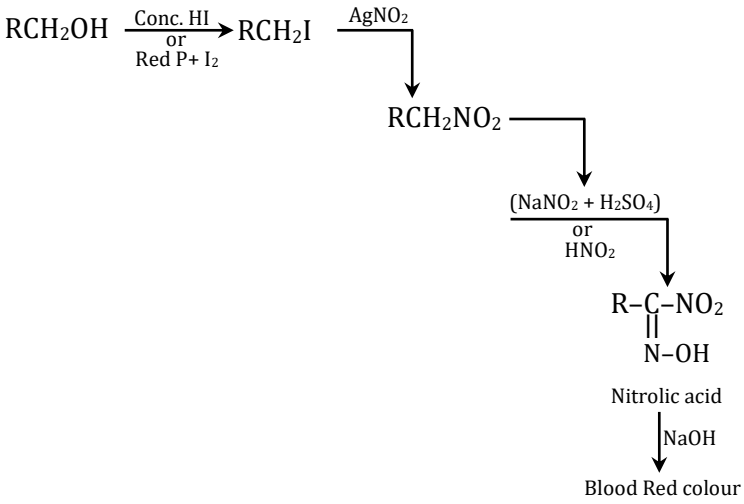
$CH_2=CH-CH_2-Br + C_6H_5O^{\ominus}Na^{\oplus} \longrightarrow CH_2=CH-CH_2-O-C_6H_5$

(Allyl phenyl enther)

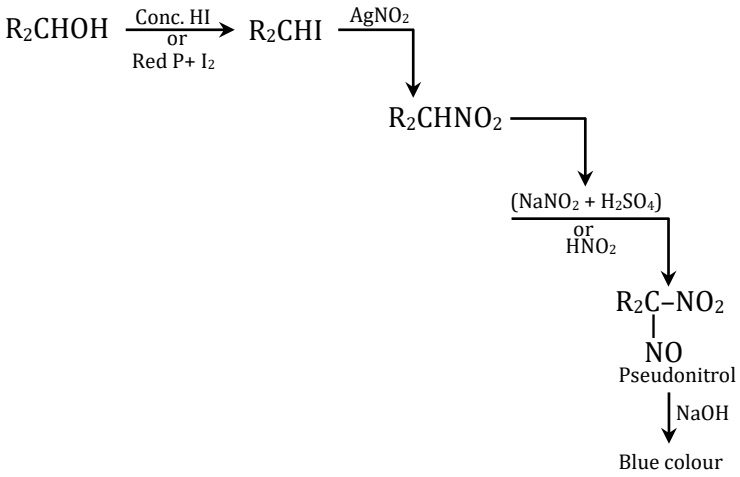
5. Ans. (1)

Victor Meyer's Test

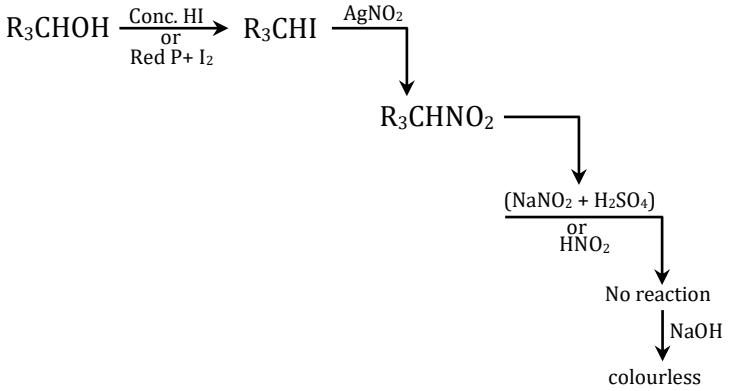
1°Alcohol



2°Alcohol

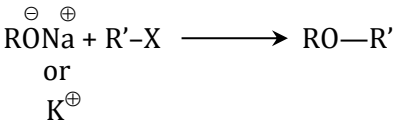


3°Alcohol



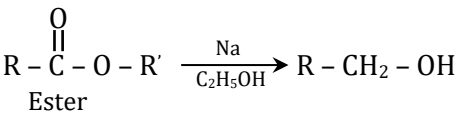
6. Ans. (3)

Williamson ether synthesis is an example of Nucleophilic substitution reaction.



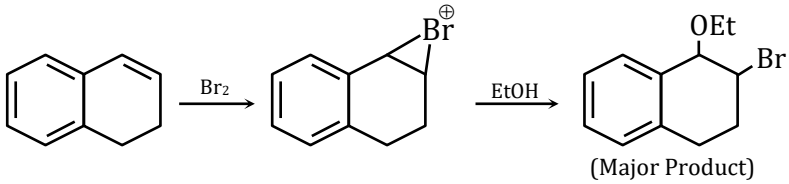
7. Ans. (1)

Bouveault – Blanc reduction :-



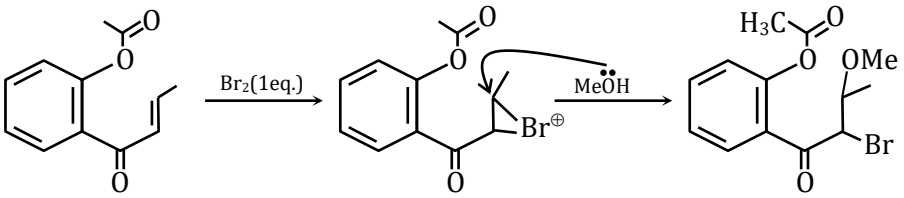
8. Ans. (4)

The major product formed is:



9. Ans. (2)

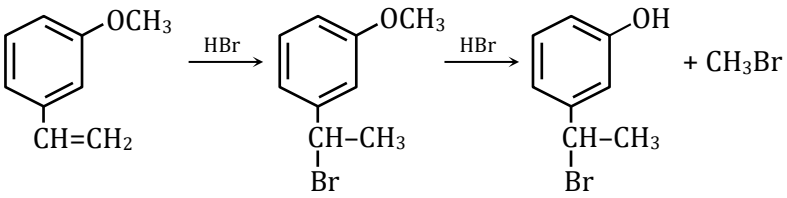
The major product formed is :



Major Product

10. Ans. (4)

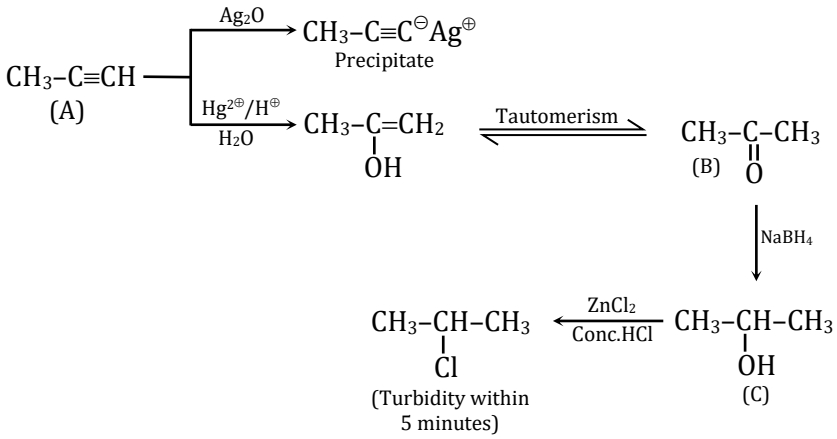
The reaction involved as :



(Major Product)

11. Ans. (2)

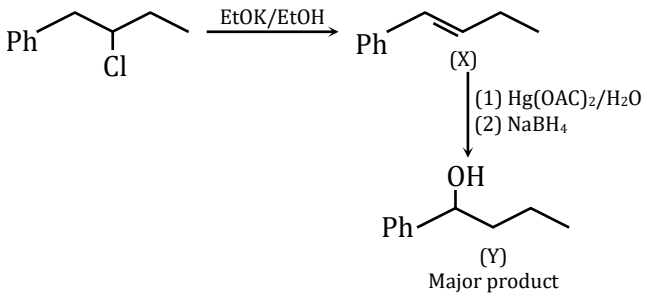
The complete reaction sequence is :



∴ Compound A is $H_3C–C\equiv CH$.

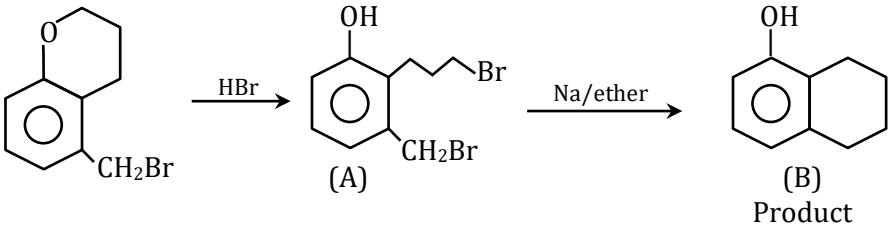
12. Ans. (4)

The product formed is :



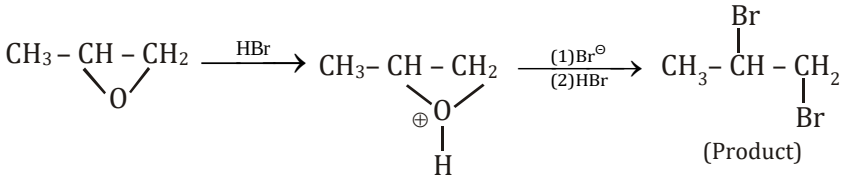
13. Ans. (4)

The product formed is :

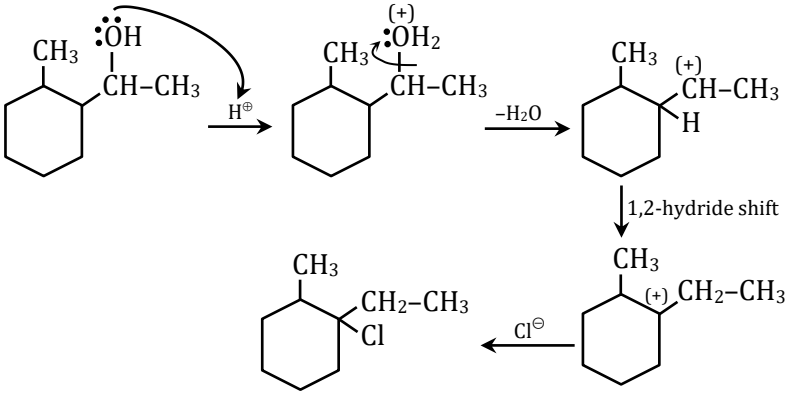


14. Ans. (4)

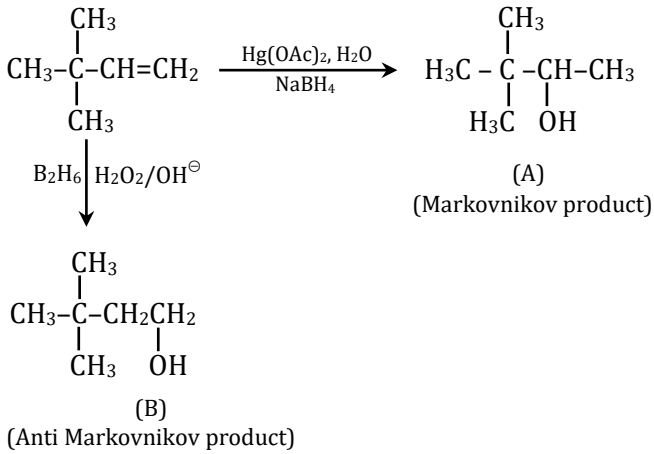
The product formed is :



15. Ans. (2)



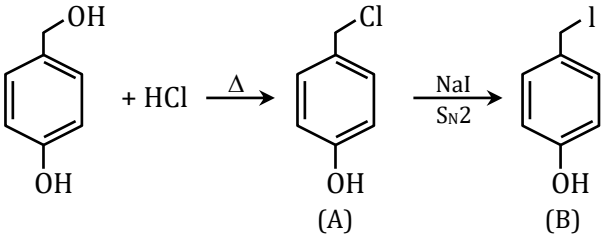
16. Ans. (2)



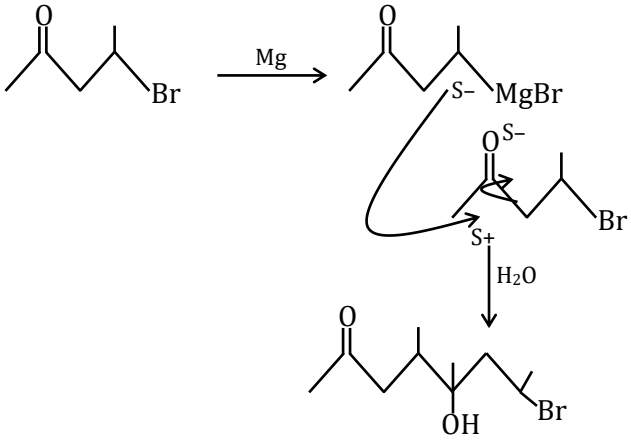
(A)
(Markovnikov product)

(B)
(Anti Markovnikov product)

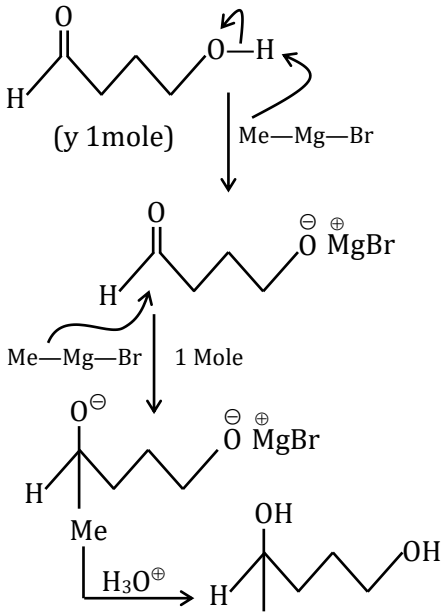
17. Ans. (1)



18. Ans. (4)

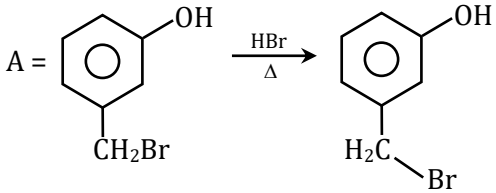


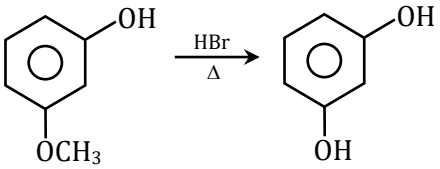
19. Ans. (2)



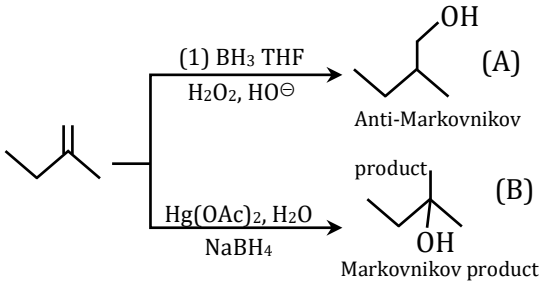
$\therefore$ x = 2 mole ; $\frac{x}{y} = \frac{2}{1} = 2$

20. Ans. (4)





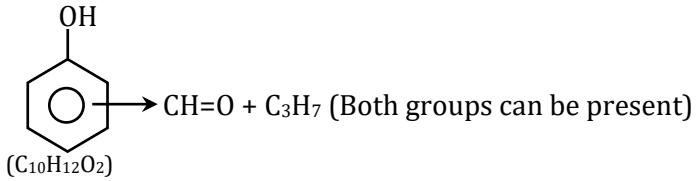
21. Ans. (1)



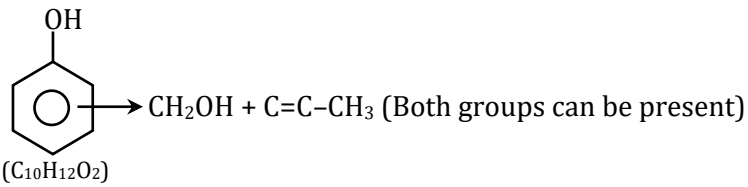
22. Ans. (4)

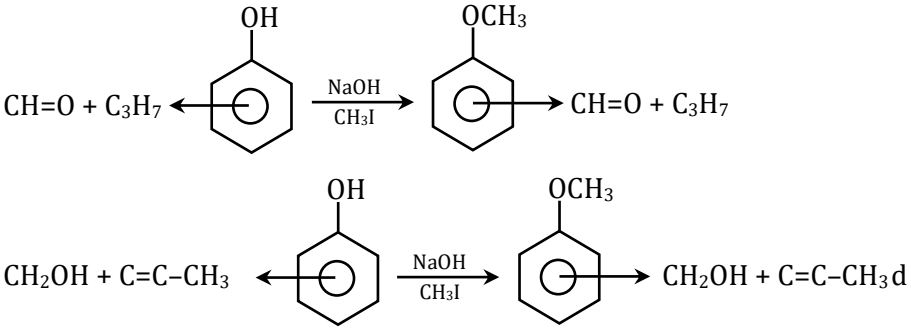
A solution of CrO_5 in amyl alcohol has a blue colour. So, option (4) is correct.

23. Ans. (4)



or





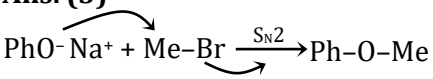
24. Ans. (1)

Butan-1-ol ($CH_3CH_2CH_2CH_2OH$) can undergo hydrogen bonding. Ethoxyethane ($CH_3CH_2–O–CH_2CH_3$) has no hydrogen (attached with F, O, N) which can undergo hydrogen bonding.

More is the extent of intermolecular H-bonding, more will be association of molecules. Thus, leading to higher boiling point.

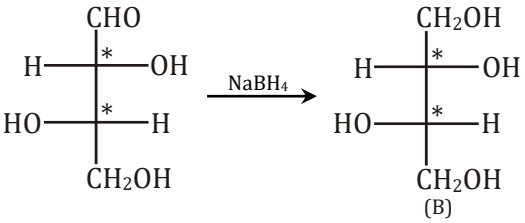
Hence both Assertion (A) and Reason(R) are true and (R) is the correct explanation of (A).

25. **Ans. (3)**

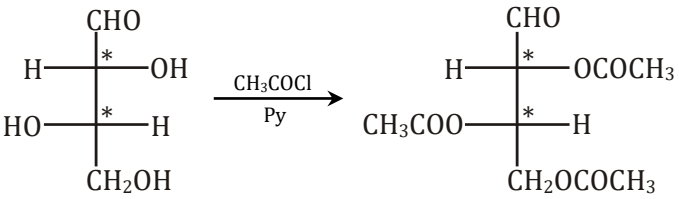


26. **Ans. (1)**

Ozonolysis of alkene, gives aldehyde, ketone & carboxylic acid.



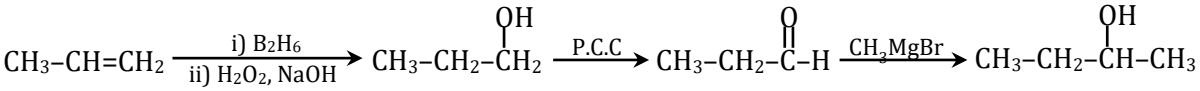
Optically active



(x) gives positive schiff's test due –CHO group

(x) is L–tetrose.

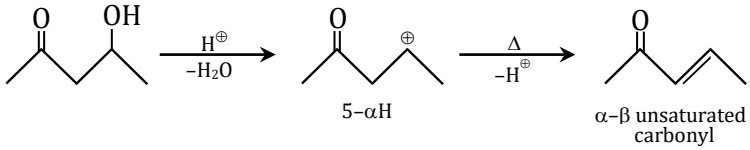
27. **Ans. (1)**



EXERCISE - JEE (Advanced) PYQ

1. **Ans. (A)**

Dehydration of β-hydroxy carbonyl compounds is fast.



2. **Ans. (B)**

The correct order of boiling point.

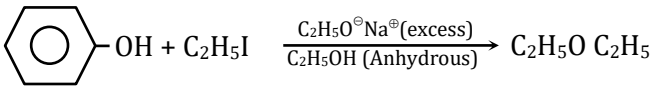
CH_3CH_2COOH > $CH_3CH_2CH_2CH_2–OH$ > $CH_3CH_2CH_2CHO$

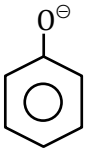
(3) (1) (2)

(Strong H-bond) (Weak H-bond)

3. **Ans. (D)**

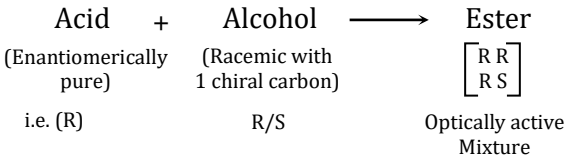
The product formed is :



Nucleophilic strength : $C_2H_5O^{\ominus}$ > 

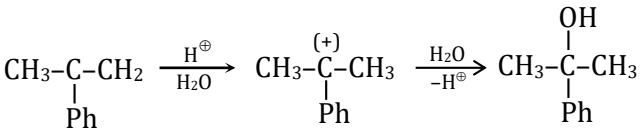
4. **Ans. (B)**

The reaction will proceed as :



5. **Ans. (D)**

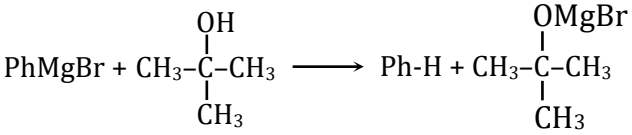
The product formed is :



2-phenyl propene 2-phenyl-2-propanol

6. **Ans. (B)**

Phenyl magnesium bromide will behave as base and abstracts proton from t-butyl alcohol.



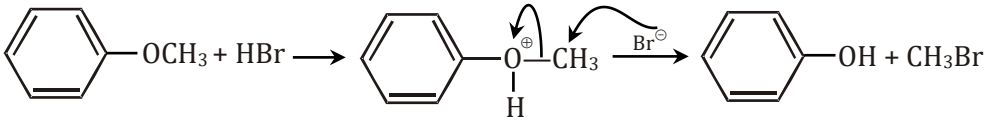
7. **Ans. (4)**

$CuSO_4.5H_2O$ exist as $[Cu(H_2O)_4]SO_4.H_2O$

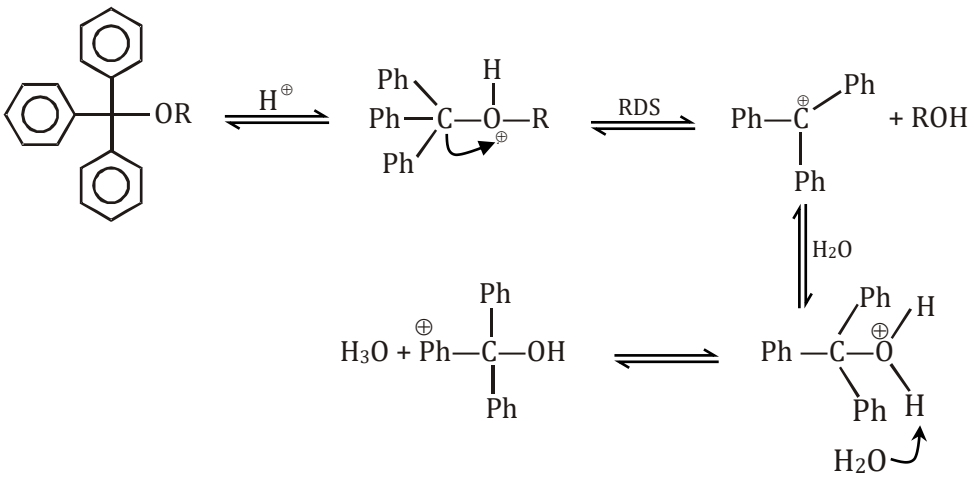
$\therefore$ Four water molecule directly coordinated to $Cu^{2\oplus}$.

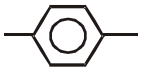
8. **Ans. (D)**

The product formed are:



9. **Ans. (C)**



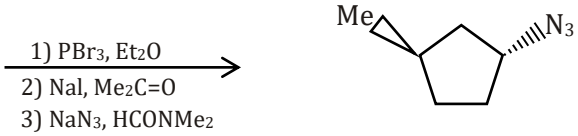
If 2 Ph groups are substituted by 2 MeO  groups then carbocation formed in above sequence will become more stable and rate of above hydrolysis increases.

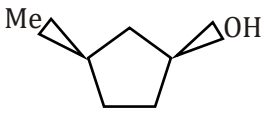
10. Ans. (ACD)

The combination of names for isomeric alcohols with molecular formula $C_4H_{10}O$ is/are

Formula	Names
$CH_3CH_2CH_2CH_2OH$	n–butyl alcohol / butan–1–ol
$CH_2(CH_3)-CH_2-OH$	Isobutyl alcohol / 2–methyl propan–1–ol
$CH_3-CH_2-CH(CH_3)-OH$	Secondary butyl alcohol / butan–2–ol
$CH_3-C(CH_3)_2-OH$	Tertiary butyl alcohol/2–metyl propan–2–ol

11. Ans. (B)

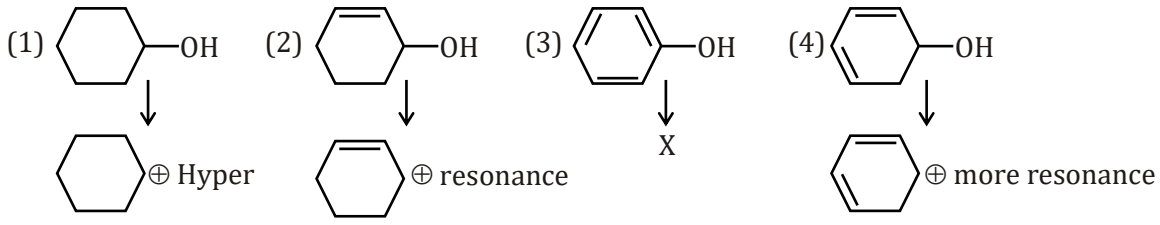


all the three reaction are S_{N^2} so X is 

JEE (Main) Practice Paper

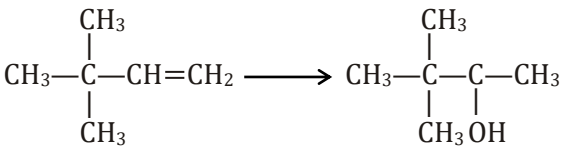
SECTION-A

1. Ans. (3)



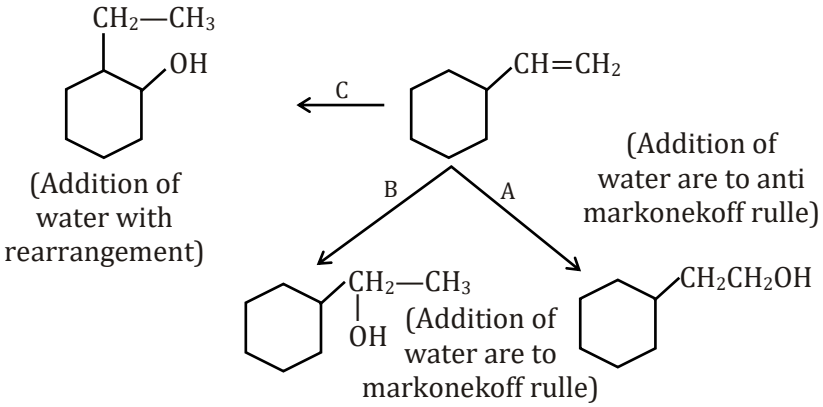
$4 > 2 > 1 > 3$

2. Ans. (2)

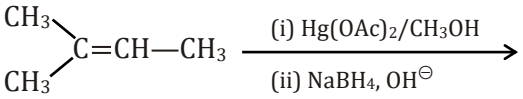


In the above conversion addition of water on alkene is done by markonikoff rule without rearrangement of carbocation, which is only possible in oxymereurations-dumercuration

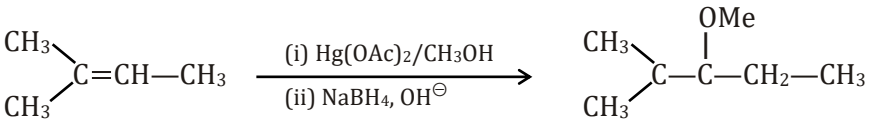
3. **Ans. (3)**



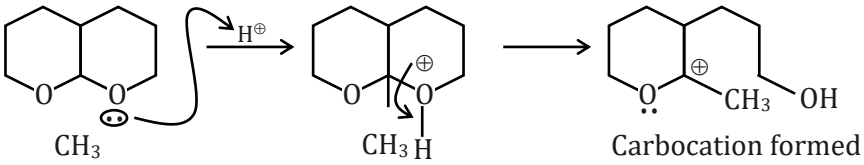
4. **Ans. (1)**

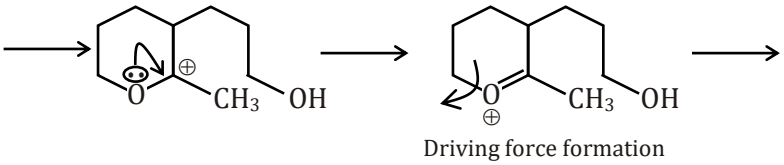


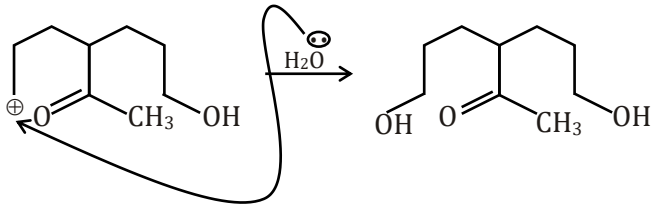
the reagent is of oxymercuration and de-mercuration, here the CH_3 — OH will take place according to markonikov's rule.



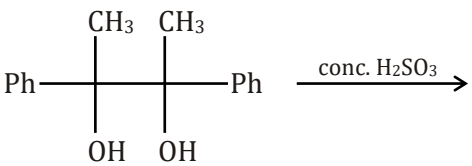
5. **Ans. (1)**





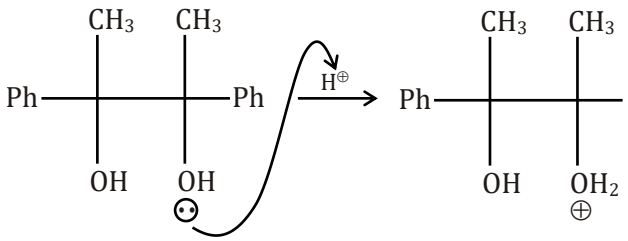


6. **Ans. (3)**

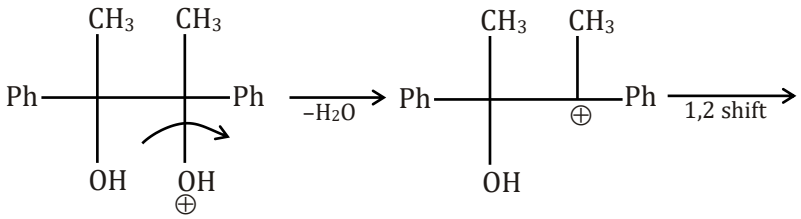


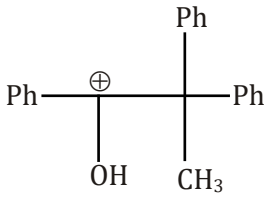
the above reaction is pinacole-pinacole rearrangement

STEP-1



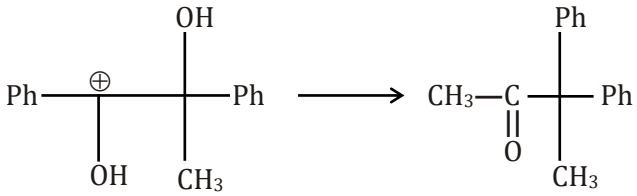
STEP-2





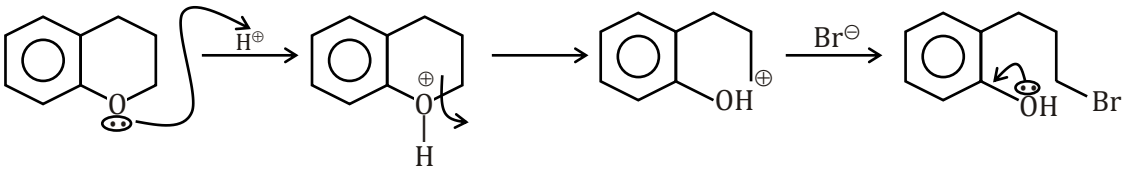
(migratory aptitude H > Ph > R)

STEP-3



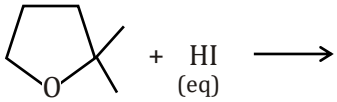
7. **Ans. (2)**

Reaction of ether with HBr

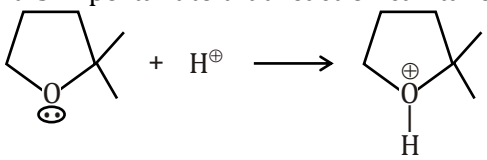


further reaction is not possible as water cannot be removed for the product due to formation of carbocation is not possible on longest ring also *l*.p. of oxygen are involved in resonance.

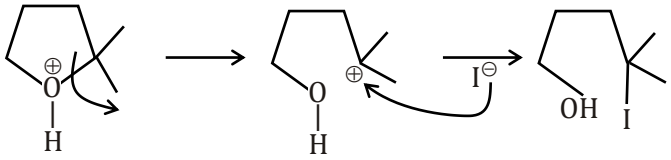
8. **Ans. (1)**



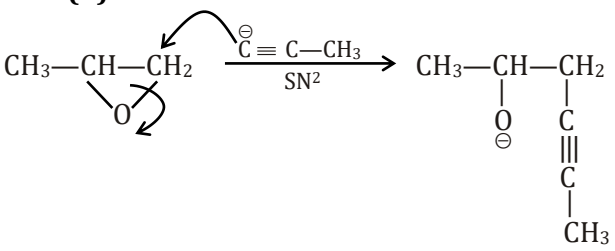
It is important to that reaction can take place only one equivalent of HI



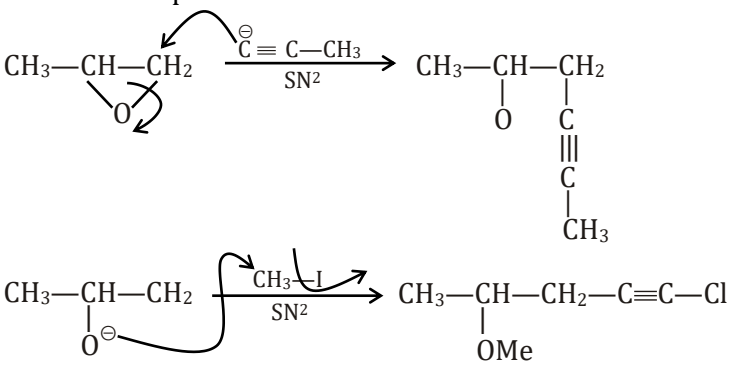
Now breaking of bond will take place according stability of carbocation



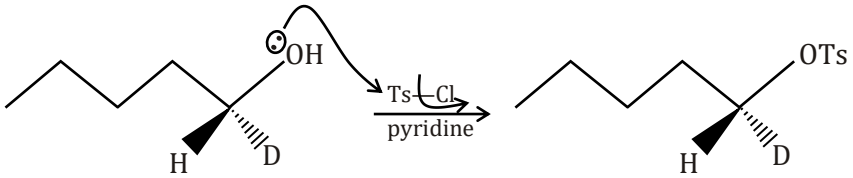
9. Ans. (2)



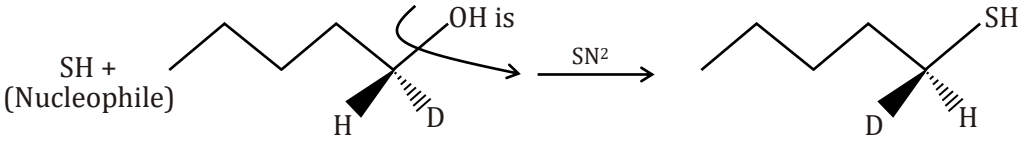
in the and step



10. Ans. (2)

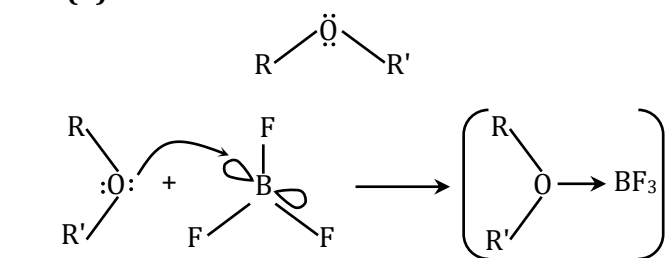


It is SN^2 reaction in which a bad leaving group — OH converted in good leaving group — OTs



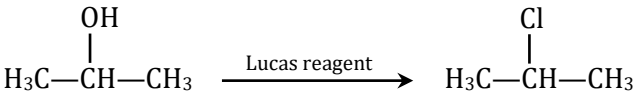
Inversion will take place due to back side attack (SN^2)

11. Ans. (2)



(has complete octet) (has incomplete octet)

12. Ans. (3)



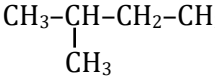
Turbidity = 5 minutes

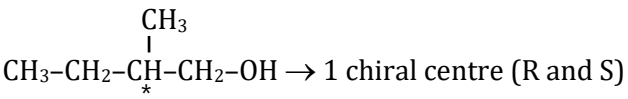
But above turbidity is not possible for primary alcohol.

13. Ans. (4)

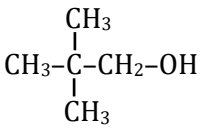
Given molecular formula $C_5H_{12}O$, DOU = 0

Possible alcohols: $CH_3–CH_2–CH_2–CH_2–CH_2–OH$



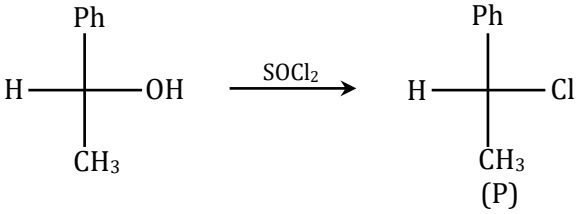


$CH_3–CH_2–\overset{*}{C}H–CH_2–OH \rightarrow$ 1 chiral centre (R and S)



Total $\Rightarrow$ Five primary alcohols are possible.

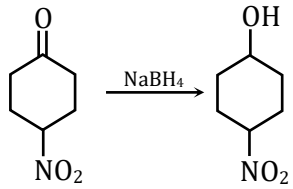
14. Ans. (1)



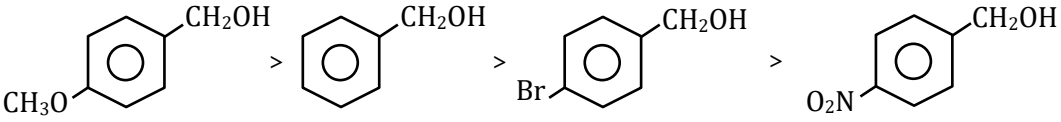
Above reaction follow S_Ni mechanism

15. Ans. (2)

The above conversion can be achieved by $NaBH_4$.



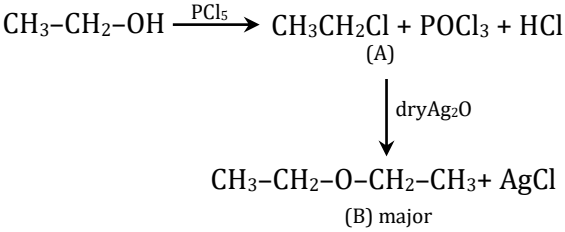
16. Ans. (1)



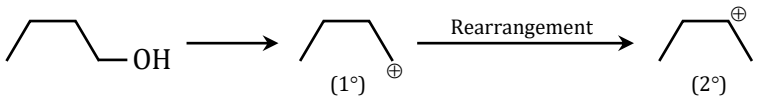
17. Ans. (2)

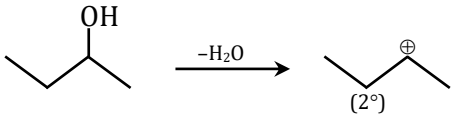
Ph—O—Ph is very least reactive to cleavage with conc. HBr

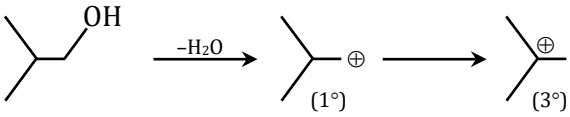
18. Ans. (1)

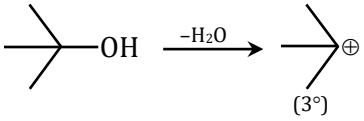


19. Ans. (3)

(I) 

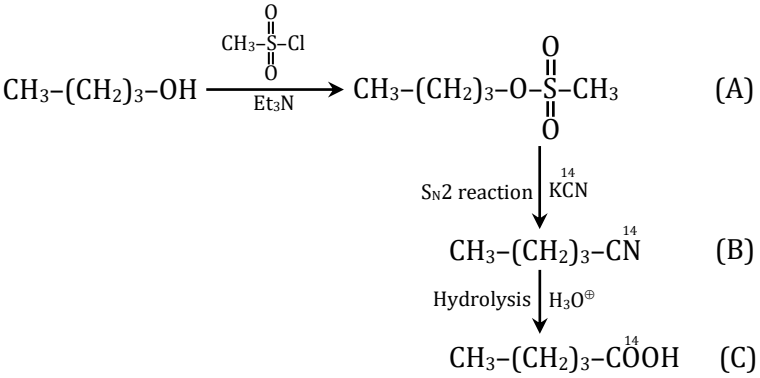
(II) 

(III) 

(IV) 

20. Ans. (2)

The complete reaction sequence is :



SECTION-B

1. Ans. (5)

The compounds giving 1° alcohol on reaction with $LiAlH_4$ are :

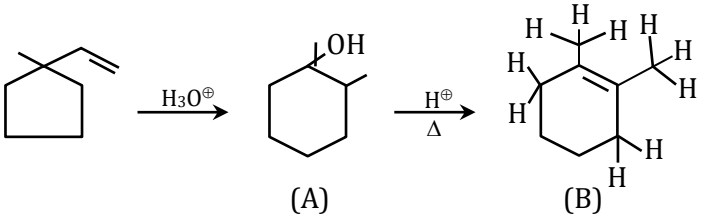
(A) CH_3CHO (C) PhCHO (D) $CH_3-\overset{O}{\overset{\|}{C}}-Cl$

(E) $C_2H_5-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3$ and (H) HCHO

gives 1° alcohol on reacting with $LiAlH_4$.

2. Ans. (10)

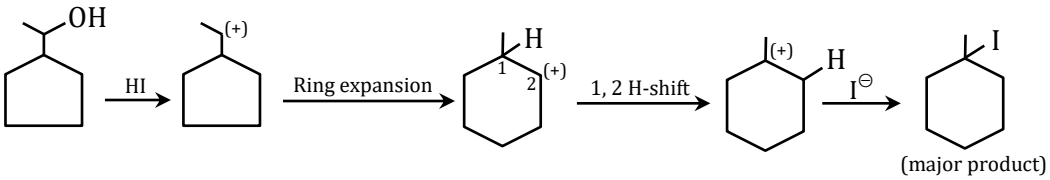
The complete reaction sequence is:



10 α-hydrogen present in B.

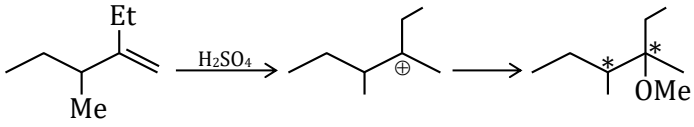
3. **Ans. (0)**

The reaction involved is :



No chiral carbon present in this product.

4. **Ans. (4)**



Total chiral centres = 2

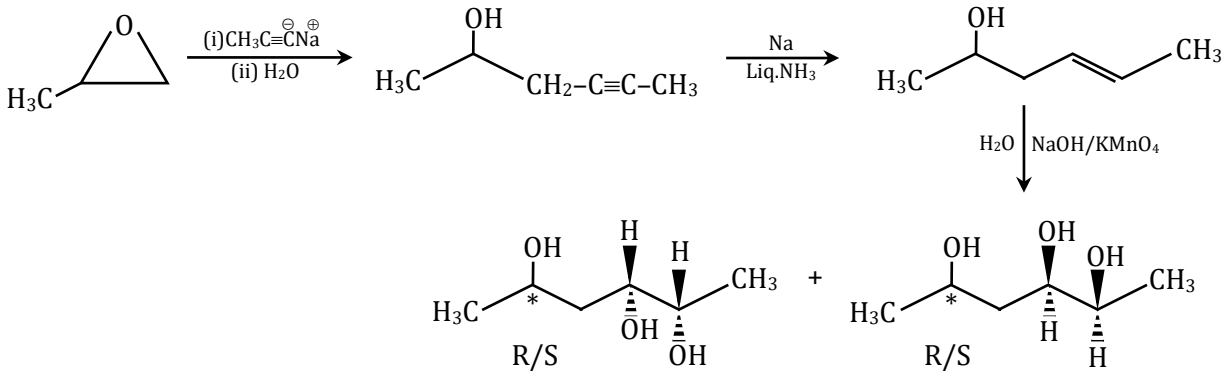
Total compounds = $2^n = 2^2 = 4$ (n = number of chiral centres)

5. **Ans. (3)**

$NaBH_4$ is a weak reducing agent and can only reduce aldehydes, ketones and acid chlorides.

(1) $R-\overset{O}{\overset{\|}{C}}-H$ (2) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ (3) $CH_3-\overset{O}{\overset{\|}{C}}-Cl$ can be reduced by $NaBH_4/H^{\oplus}$.

6. **Ans. (4)**



Total 4 different triols isomers are formed.

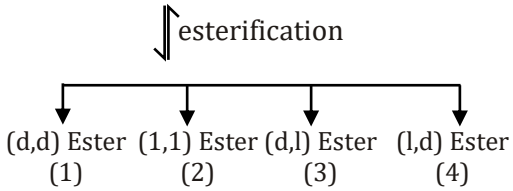
7. **Ans. (2)**

Oxidation state : $\underset{-3\ \ -2\ \ -2}{CH_3-CH_2=CH_2} \xrightarrow{[O]} \underset{-3\ \ -1\ \ -1}{CH_3-\overset{O}{\overset{/\ \backslash}{CH}}-CH_2}$ (Methyl oxirane)

Net change in oxidation state is 2.

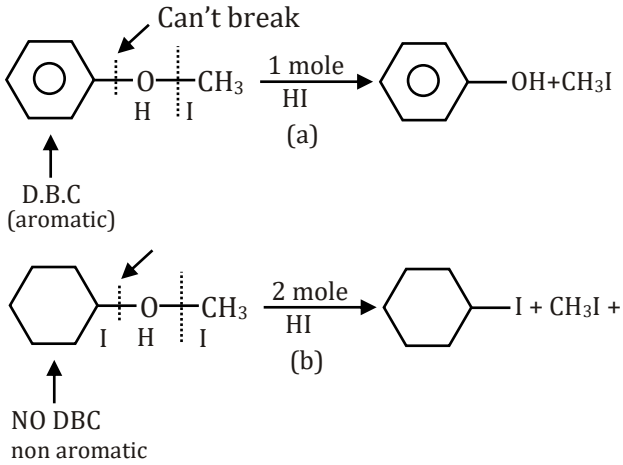
8. **Ans. (4)**

(dl) 2 methyl butanoic acid and (dl) – butanol

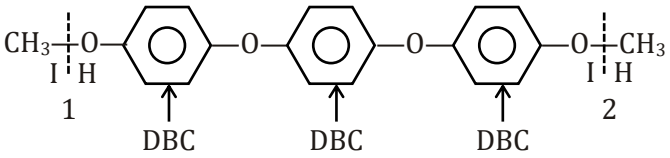


Ester consists of two stereocentres, Chiral center during whole reaction are not effected, that's why all esters are optical active.

9. Ans. (3)

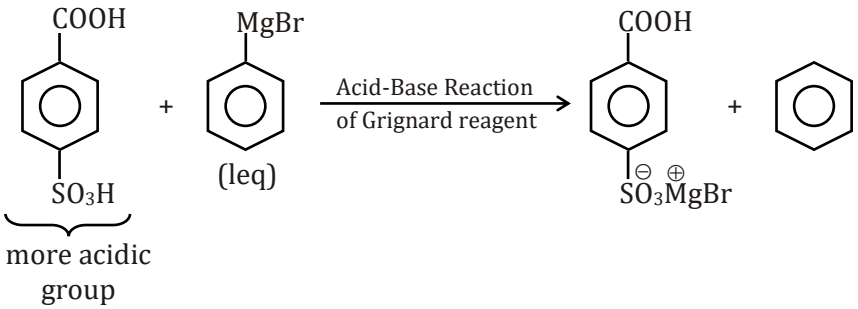


10. Ans. (2)

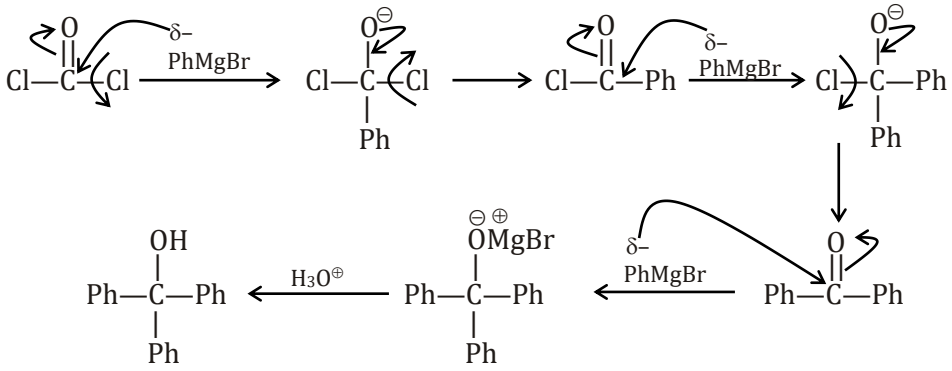


JEE (Advanced) Practice Paper

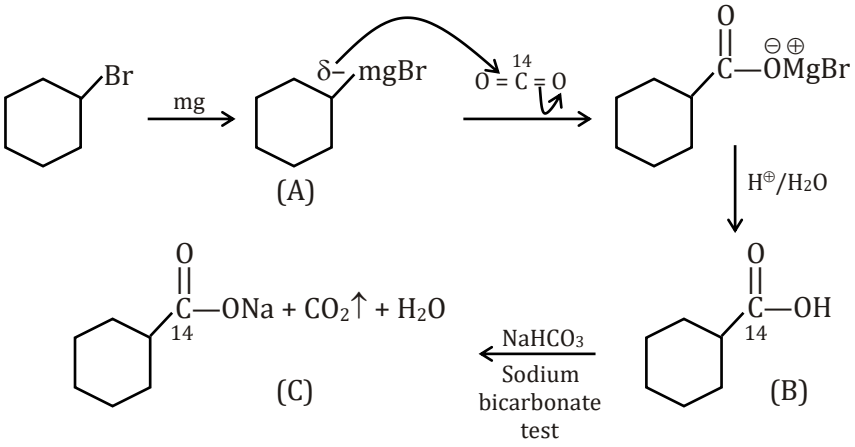
1. Ans. (C)



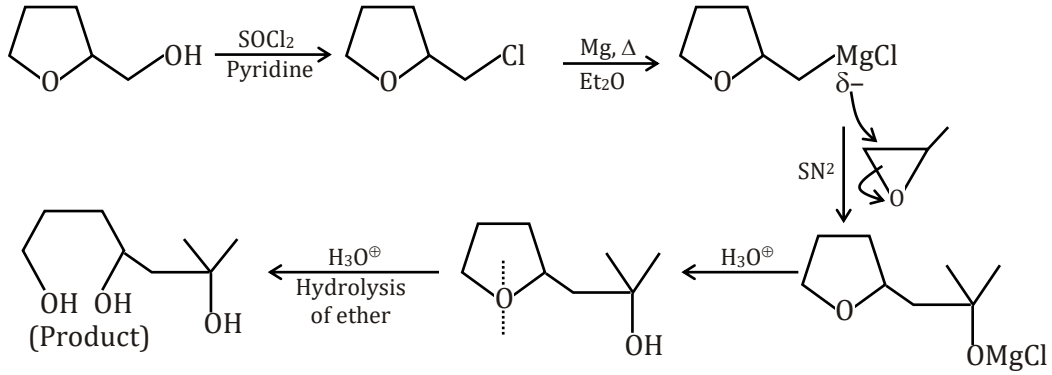
2. Ans. (C)



3. Ans. (C)

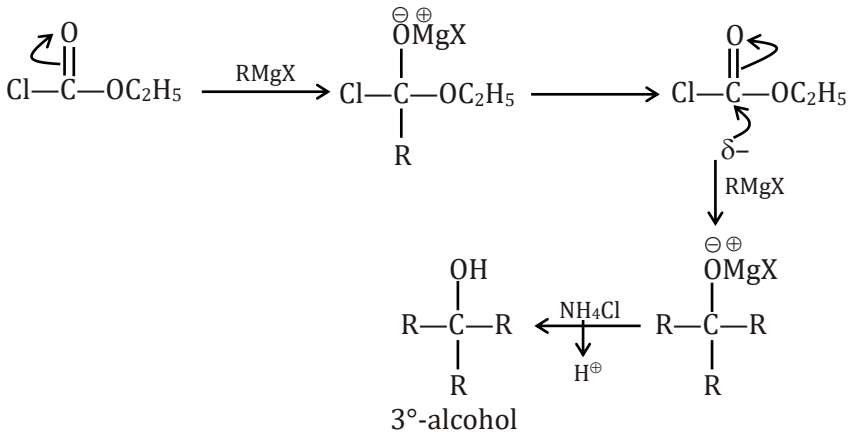


4. Ans. (D)



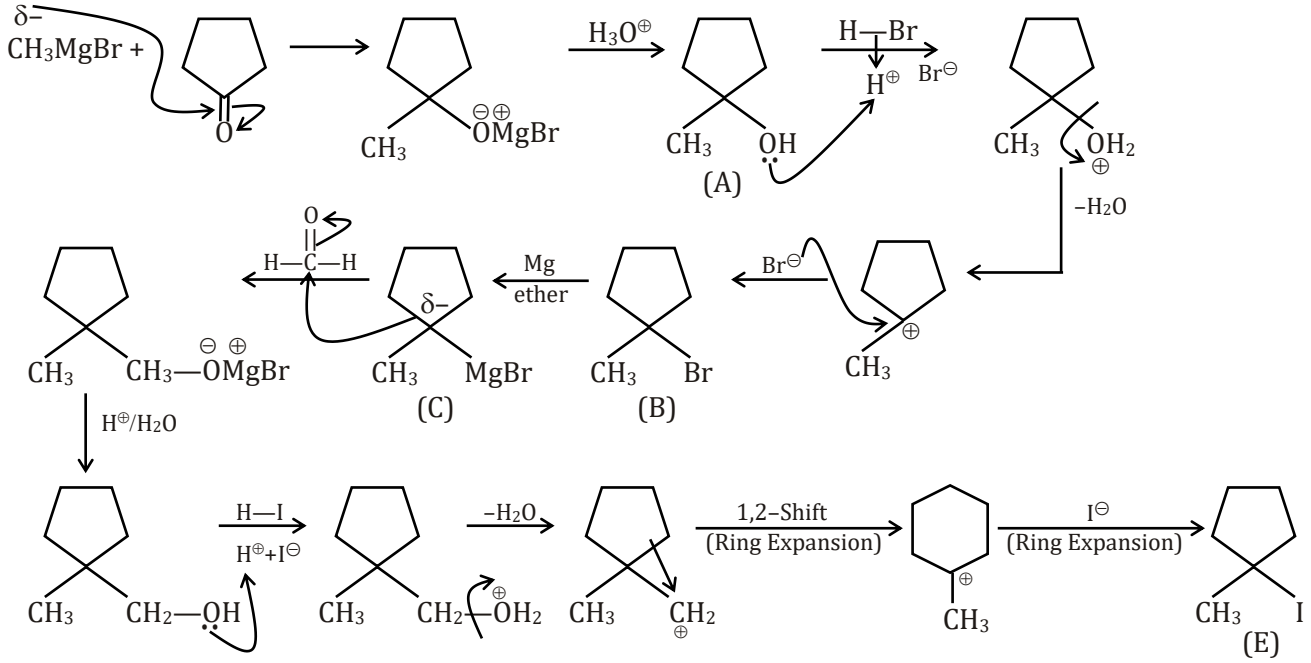
5. Ans. (B)

leaving group ability ⇒ — Cl > OC_2H_5

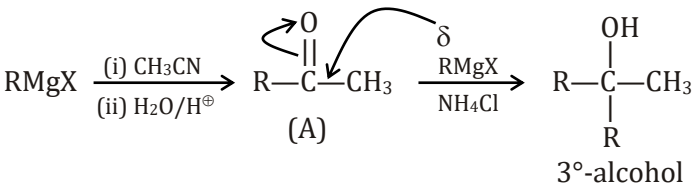


* Total two RMgX are consumed for complete reaction

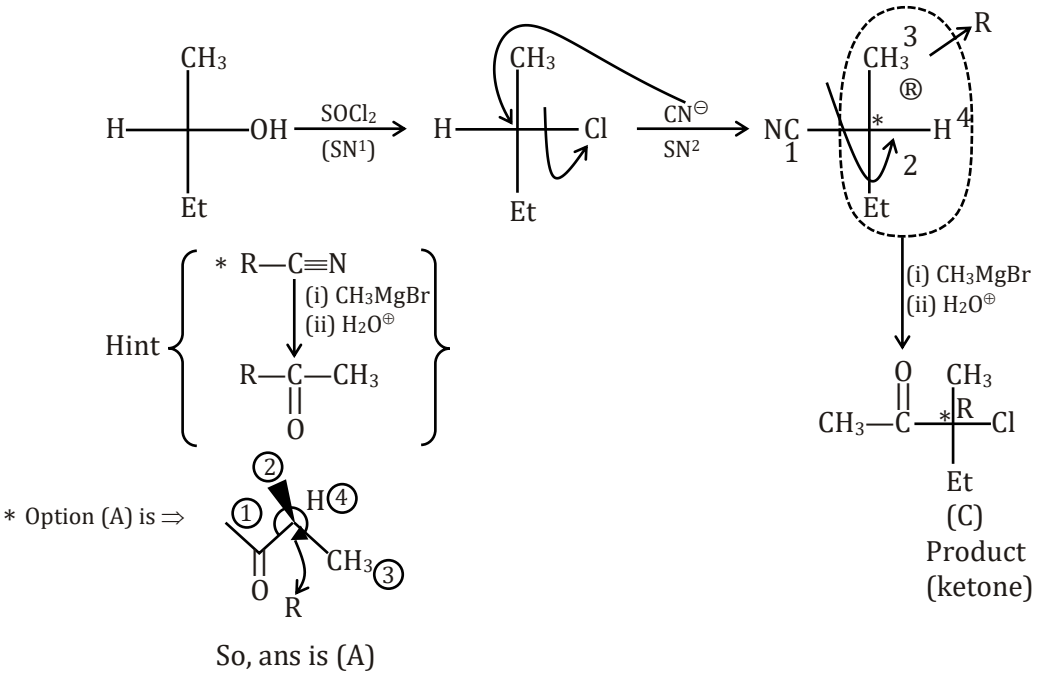
6. Ans. (D)



7. Ans. (C)

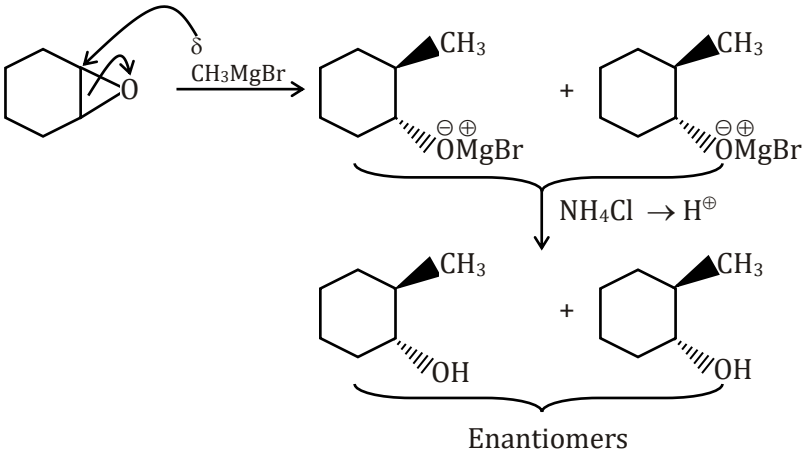


8. Ans. (A)

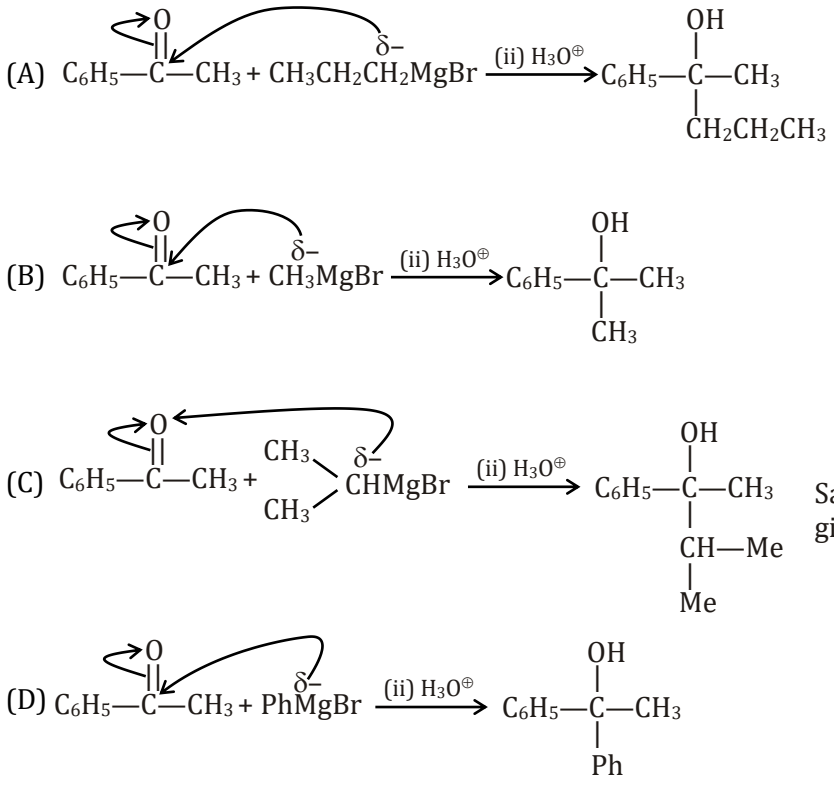


So, ans is (A)

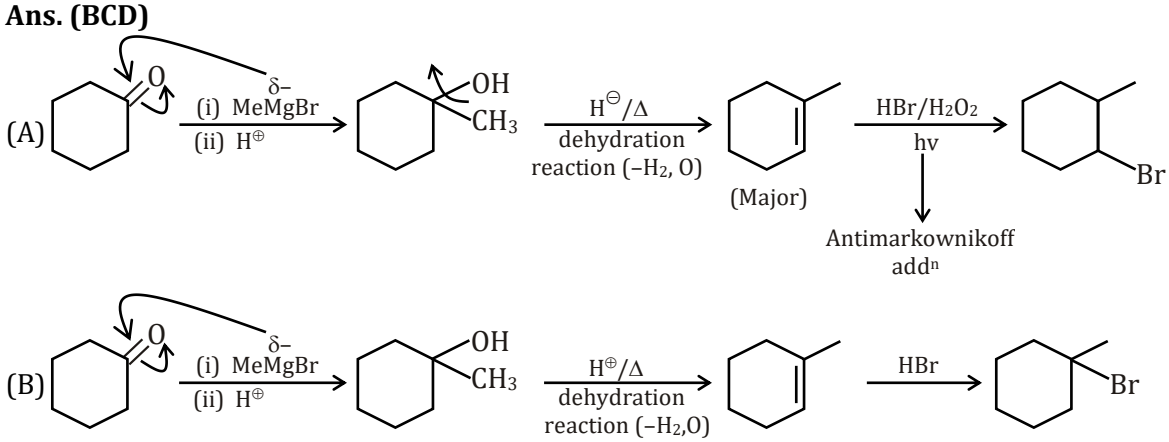
9. **Ans. (A)**

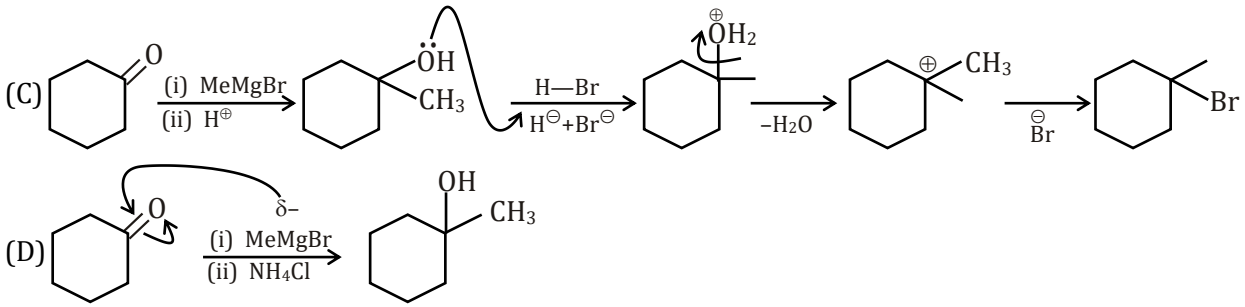


10. **Ans. (ABD)**

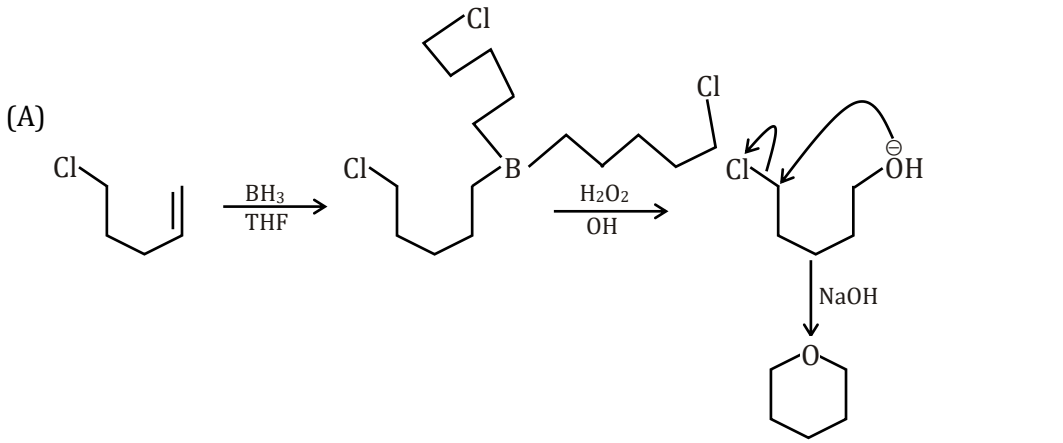


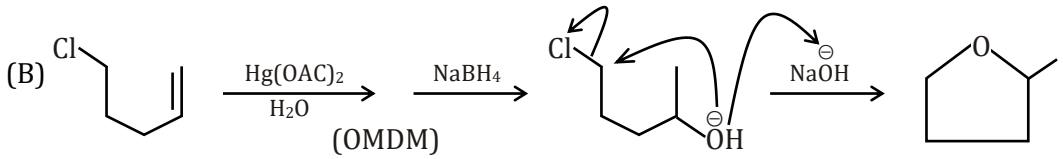
11. **Ans. (BCD)**

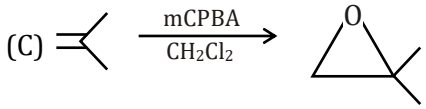




12. Ans. (ABC)



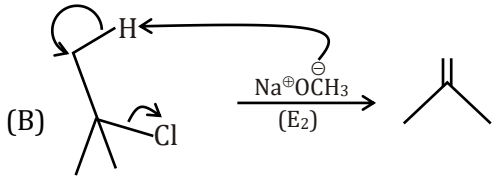


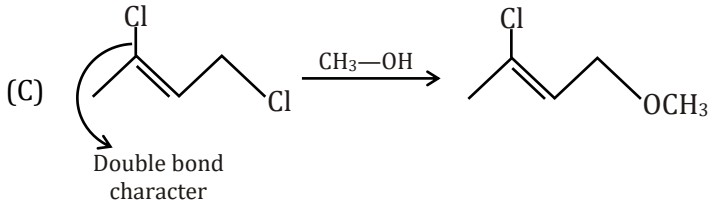


(D) No SN^2 possible due to double and character of C — Br.

13. Ans. (ABC)

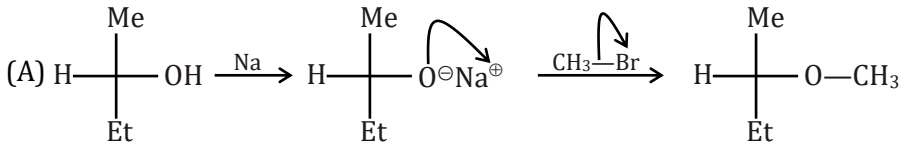
(A) Not possible due to double bond character

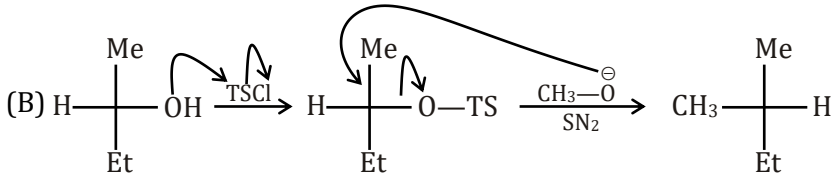


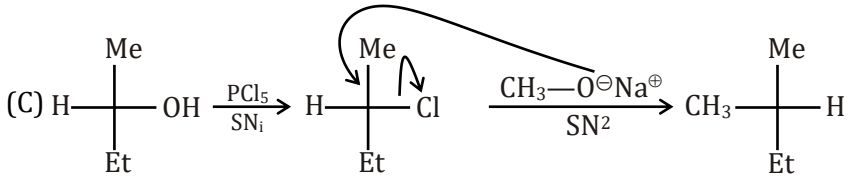


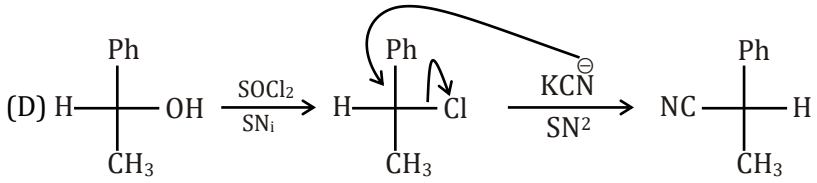
(D) Correct

14. Ans. (BCD)







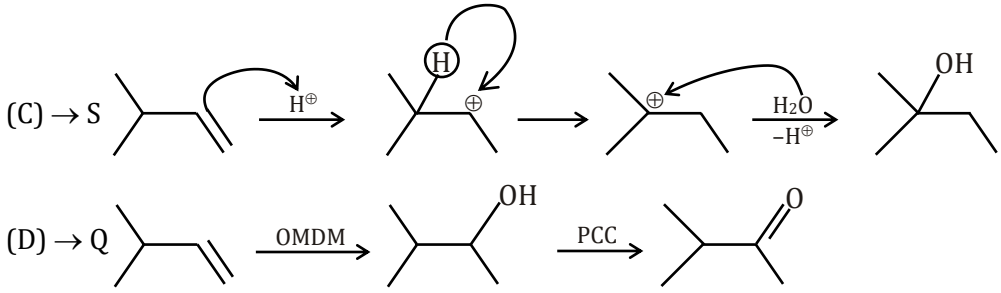


15. Ans. (A)

(A)→P; (B)→R; (C)→S; (D)→Q

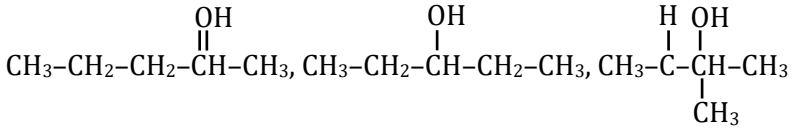
(A) → P Syn addition, Antimarkanikav (HBO)

(B) → R Anti addition, markonikav rule (OMDM)

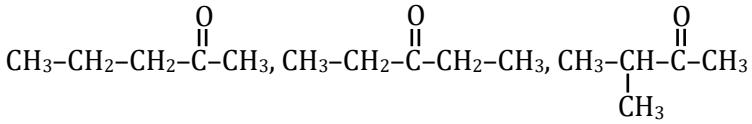


16. Ans. (3)

With the given molecular formula $C_5H_{12}O$ possible secondary alcohols are :



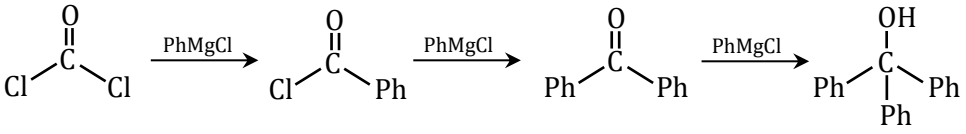
⇒ These can be obtained by reduction of



With $LiAlH_4$

17. Ans. (3)

The Reaction involved is :



Total moles of PhMgCl used = 3

18. Ans. (4)