BYJU'S Study Planner for Board Term I
(CBSE Grade 12)

Date: 12/11/2021

Subject: Chemistry

Topic : Alcohols, Phenols and Ethers

Class: Standard XII

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1. A Phenol (C_6H_5OH) contains $-OH$ group(s) directly attached to sp^2 hybridized carbon atom(s) of an aromatic system. In phenols the $-OH$ group is attached to sp^2 hybridized carbon of an aromatic ring.
The carbon- oxygen bond length in phenol is slightly less than that in methanol.
Phenol can be prepared by various means such as through alkali fusion of sulphonates, hydrolysis of diazonium salts etc. Commercially it is prepared from Dow's process.

   The name of product which is obtained by the decarboxylation of sodium salt of salicylic acid with soda-lime is:

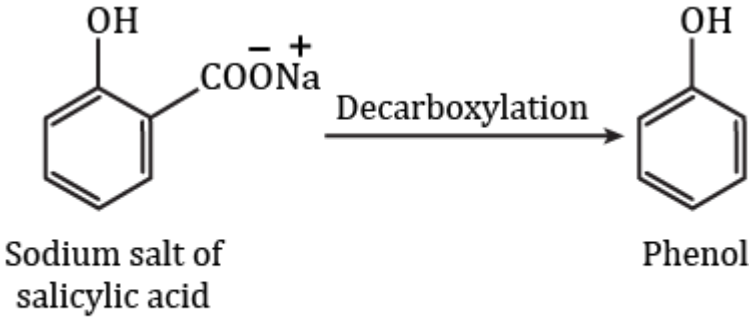
   ✔ **A.** Phenol

   ✘ **B.** Tolune

   ✘ **C.** Benzene

   ✘ **D.** Benzoic acid

   The decarboxylation of sodium salt of salicylic acid with soda-lime gives phenol.



Sodium salt of salicylic acid — Phenol

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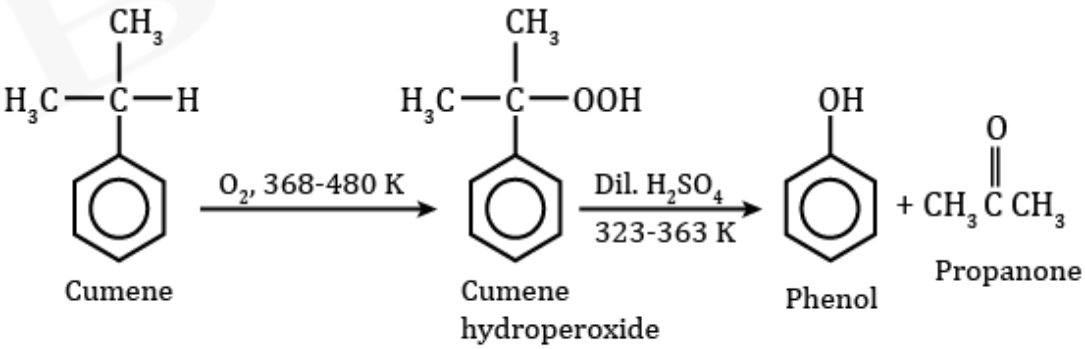
2. A Phenol (C_6H_5OH) contains $-OH$ group(s) directly attached to sp^2 hybridized carbon atom(s) of an aromatic system.
The carbon- oxygen bond length in phenol is slightly less than that in methanol.
Phenol can be prepared by various means such as through alkali fusion of sulphonates, hydrolysis of diazonium salts etc. Commercially it is prepared from Dow's process.

Which of the following can produce phenol?

- ✗ **A.** Reduction of aniline
- ✗ **B.** Reduction of chlorobenzene
- ✓ **C.** Oxidation of cumene followed by hydrolysis
- ✗ **D.** Acidification of chlorobenzene

Oxidation of Cumene in presence of air gives cumene hydroperoxide which is converted to phenol and acetone by treating with dilute acid.



3. A Phenol (C_6H_5OH) contains $-OH$ group(s) directly attached to sp^2 hybridized carbon atom(s) of an aromatic system.
The carbon- oxygen bond length in phenol is slightly less than that in methanol.
Phenol can be prepared by various means such as through alkali fusion of sulphonates, hydrolysis of diazonium salts etc. Commercially it is prepared from Dow's process.
The ionisation constant of phenol is higher than that of ethanol because:

✗ **A.** Phenoxide ion is bulkier than ethoxide

✗ **B.** Phenoxide ions is stronger base than ethoxide

✓ **C.** Phenoxide ions is stabilised through delocalisation

✗ **D.** Phenoxide ion is less stable than ethoxide

Phenoxide ion is more stabilised than ethoxide ion due to resonance. Therefore, the constant of phenol is higher than ethanol.

4. Which of the following analogies is correct regarding dehydration of ethanol in presence of protic acid?
$443K$: Alkene:: $413K$:_____.

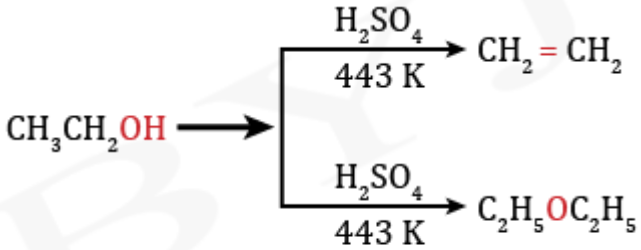
✗ **A.** Alkyne

✓ **B.** Ether

✗ **C.** Aldehyde

✗ **D.** Carboxylic acid

Alcohols undergo dehydration in the presence of protic acids, eg. (H_2SO_4, H_2PO_4). The formation of the reaction product, alkene or ether depends on the reaction conditions. For example, ethanol is dehydrated to Ethane in the presence of sulfuric acid at $443\ K$. At $413\ K$, ethoxyethane is the main product.



5. Match the following $IUPAC$ names given in Column I with their common names given in Colum II and choose the correct option from the codes given below.

	Column I ($IUPAC$ name)		Column II (Common name)
$A.$	4-Methyl phenol	1	Catechol
$B.$	Benzene-1,4-diol	2	Quinol
$C.$	Benzene-1,2-diol	3	*o*-cresol
$D.$	2-Methyl phenol	4	*p*-cresol

A.

$A.$	$B.$	$C.$	$D.$
4	2	1	3

B.

$A.$	$B.$	$C.$	$D.$
1	2	3	4

C.

$A.$	$B.$	$C.$	$D.$
1	2	4	3

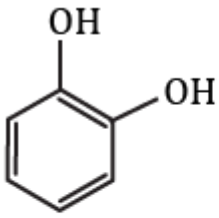
D.

$A.$	$B.$	$C.$	$D.$
4	3	2	1

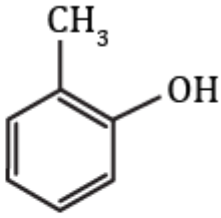
The correct match is:
$A \rightarrow 4;\ B \rightarrow 2;\ C \rightarrow 1;\ D \rightarrow 3$

p-cresol
(4-methyl phenol)

Hydroquinone or quinol
(Benzene-1.4-diol)



Catechol
(Benzene-1,2-diol)



o-cresol
(2-methyl phenol)

6. Given below are two statements labelled as Assertion (A) and Reason (R).
Assertion (A): The bond angle in alcohol is slightly more than the tetrahedral angle.

Reason (R): Variation in bond angle of alcohol is due to the repulsion between the unshared electron pair of oxygen.

- ✗ **A.** Both A and R are true and R is the correct explanation of A
- ✗ **B.** Both A and R are true but R is not the correct explanation of A
- ✗ **C.** A is true but R is false
- ✓ **D.** A is false but R is true

The bond angle in alcohols is slightly less than the tetrahedral angle $(109^{\circ}28')$. It is due to the repusion between the unshared electron pair of oxygen.
Hence, Assertion is incorrect but Reason is correct.

7. Given below are two statements labelled as Assertion (A) and Reason (R).
Assertion (A): Alcohols act as Lewis bases.

Reason (R): It is due to the presence of shared electron pairs on oxygen which make them proton donors.

- ✗ **A.** Both A and R are true and R is the correct explanation of A
- ✗ **B.** Both A and R are true but R is not the correct explanation of A
- ✓ **C.** A is true but R is false
- ✗ **D.** A is false but R is true

Alcohols are Lewis bases due to the presence of unshared electron pairs on oxygen which makes them proton acceptors and electron pair donors. Thus Assertion is correct but Reason is incorrect.

8. Given below are two statements labelled as Assertion (A) and Reason (R).
Assertion (A): Di-*tert*-butyl ether cannot be prepared by Williamson's synthesis.

Reason (R): *tert*-butylbromide on treatment with sodium *tert*-butoxide preferentially undergoes elimination to from *iso*-butylene and *tert*-butyl alcohol.

✔ **A.** Both A and R are true and R is the correct explanation of A

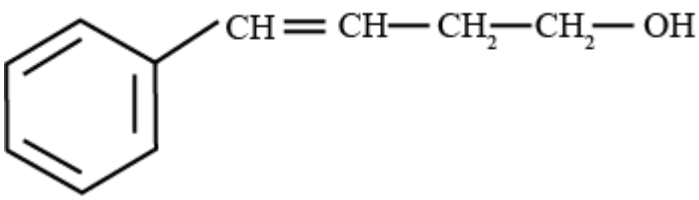
✘ **B.** Both A and R are true but R is not the correct explanation of A

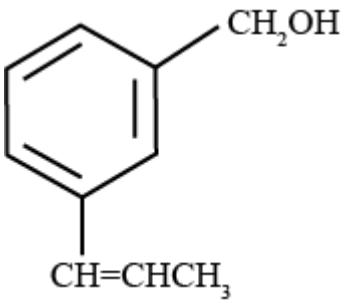
✘ **C.** A is true but R is false

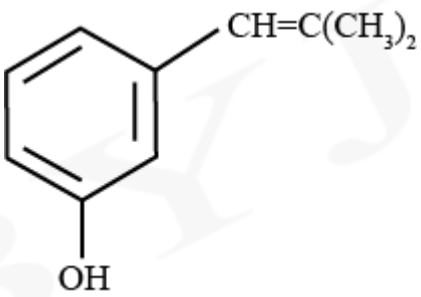
✘ **D.** A is false but R is true

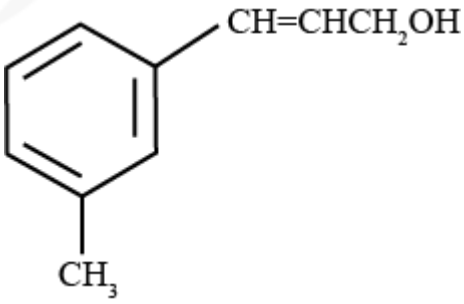
tert-Butylbromide is 3^{o} alkyl halide. Due to steric crowding, it prefer to undergo elimination instead of substituion. Hence both Assertion and Reason are correct statements and Reason is the correct explaination of the Assertion.

9. Which of the following compounds is an allylic alcohol?

A. 

B. 

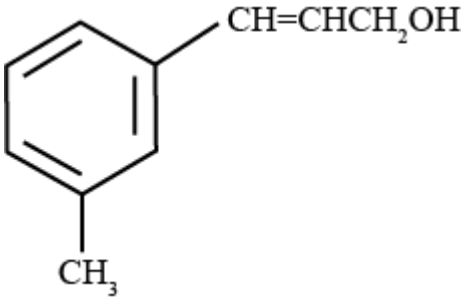
C. 

D. 

Allyic alcohol has $CH = CH - CH_2 - OH$ group.

A compound where the hydroxy group is attached to a saturated carbon atom adjacent to a doubly bonded carbon atom is known as allylic alcohol.

The compound in option (d) is allylic alcohol.



10. Propene when reacted with water in the presence of dilute H_2SO_4 gives

A. Propan-1-ol

B. Propan-2-ol

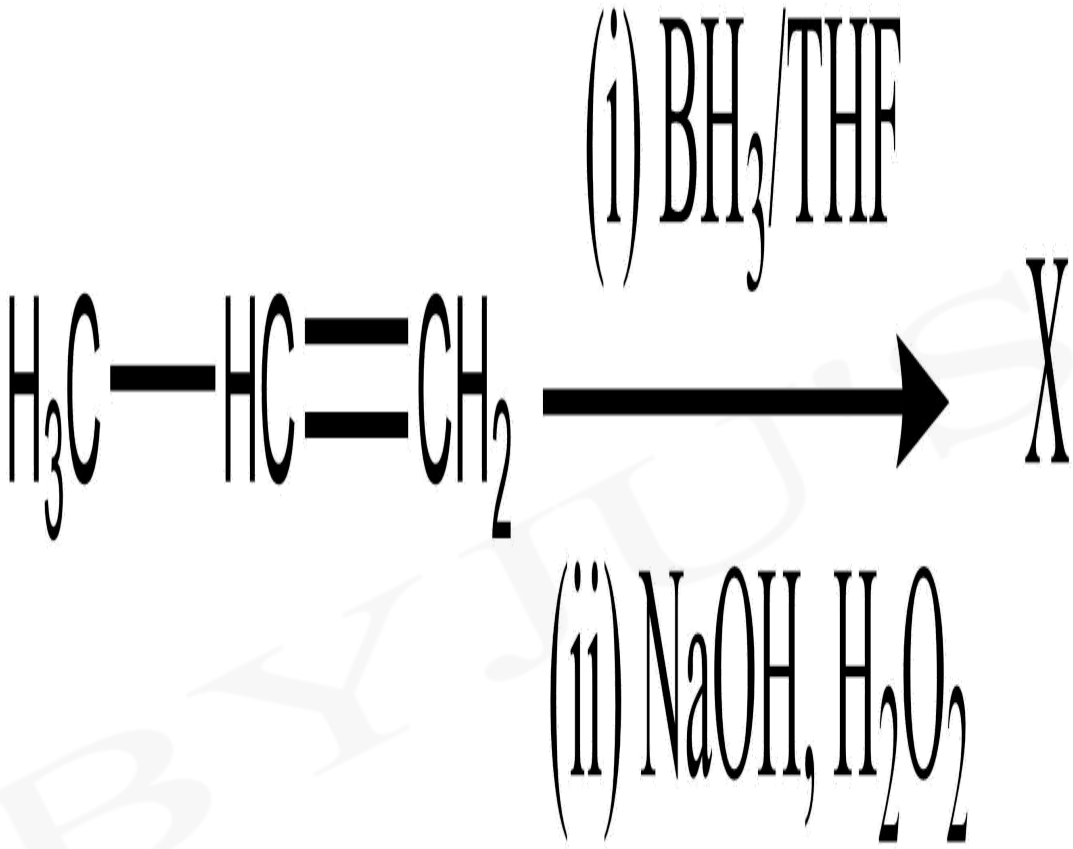
C. 2-Methylpropan-1-ol

D. 2-Methylpropan-2-ol

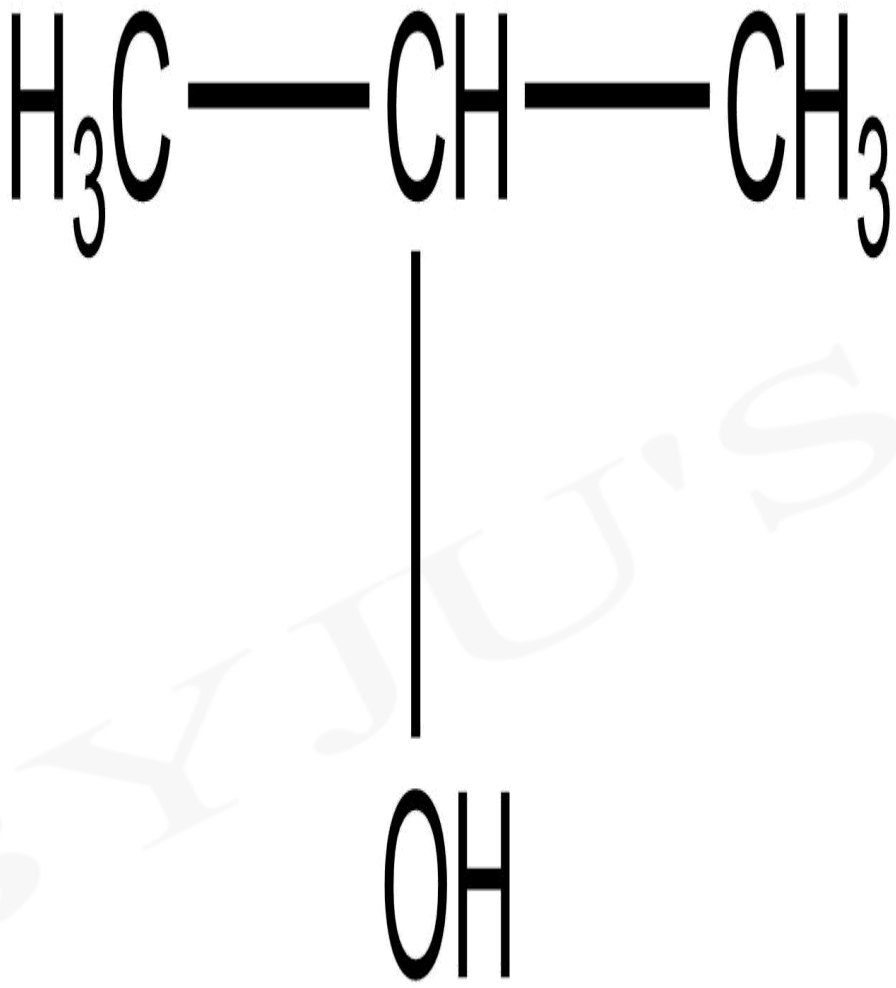
Since propene is an unsymmetrical alkene, the given hydration reaction takes place in accordance to Markovnikov's rule, to form propan-2-ol. The double bond is broken and the OH group attaches at the second carbon. The reaction is as follow:

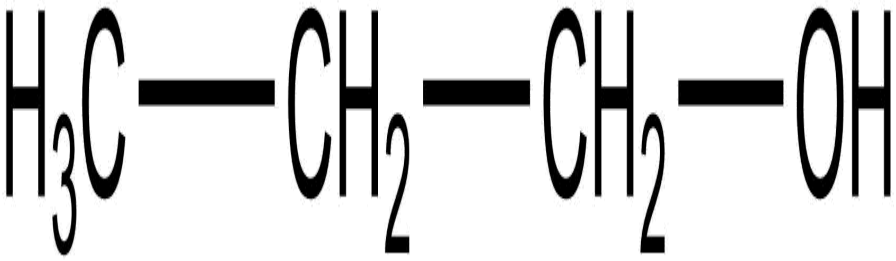
$$CH_3CH = CH_2 + H_2O \xrightarrow{dil.\ H_2SO_4} CH_3CH(OH)CH_3$$

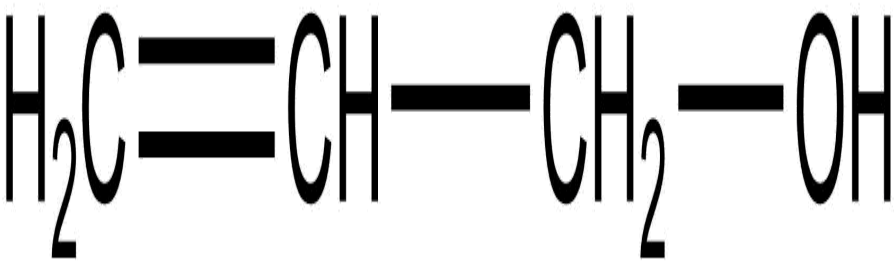
11.

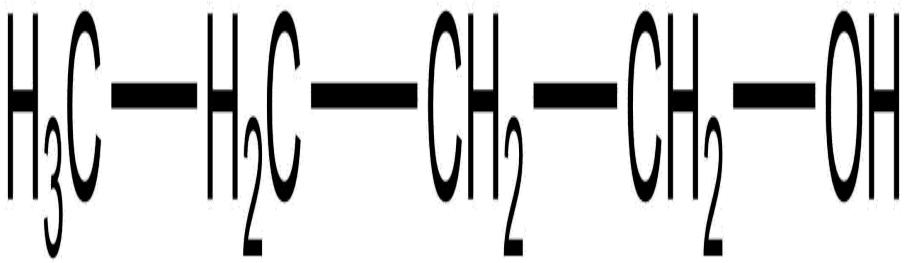


Identify product X:

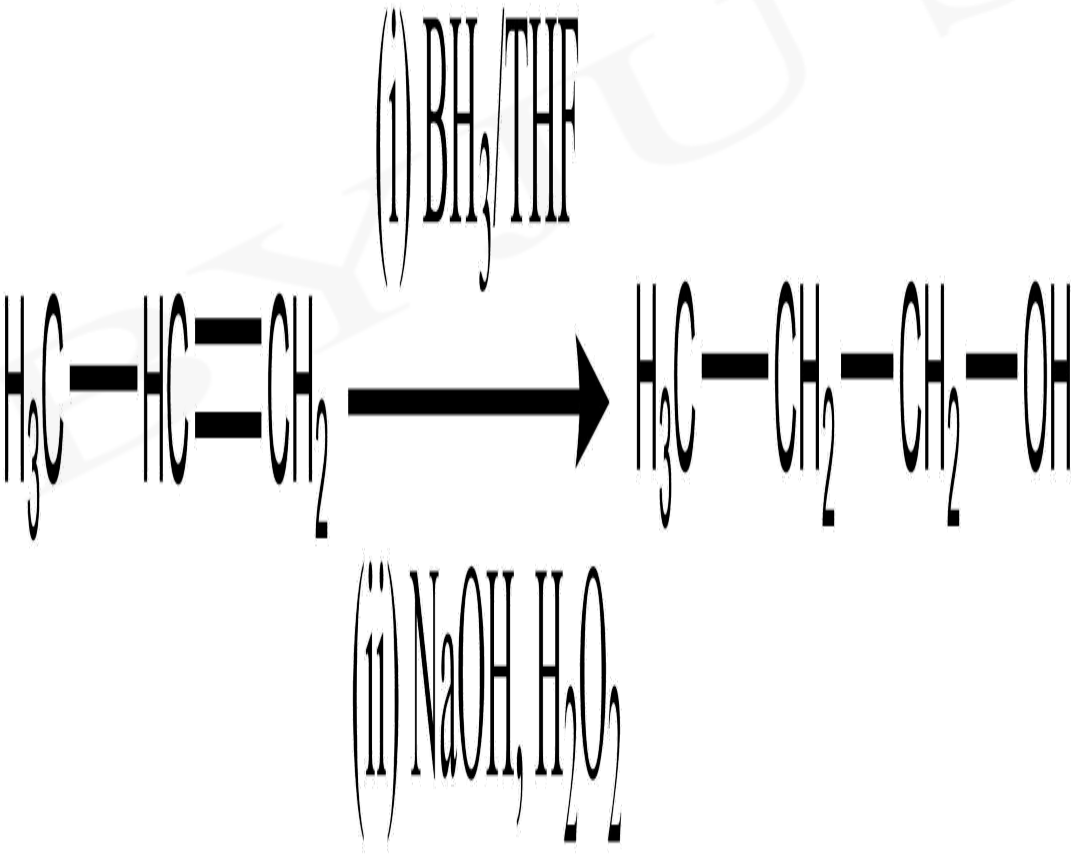
A. 

B. 

C. 

D. 

The above given reaction is known as hydroboration-oxidation reaction. If the reaction involves unsymmetrical alkenes, it follows anti markovnikov's rule.



Hence, the correct answer is option (b).
Mechanism of this reaction:

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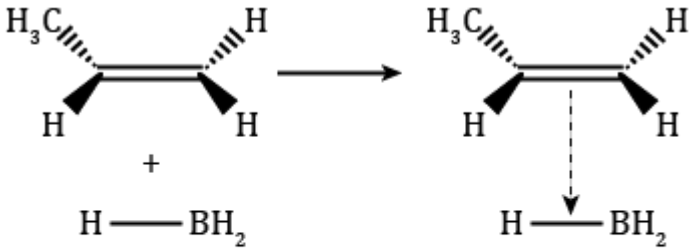
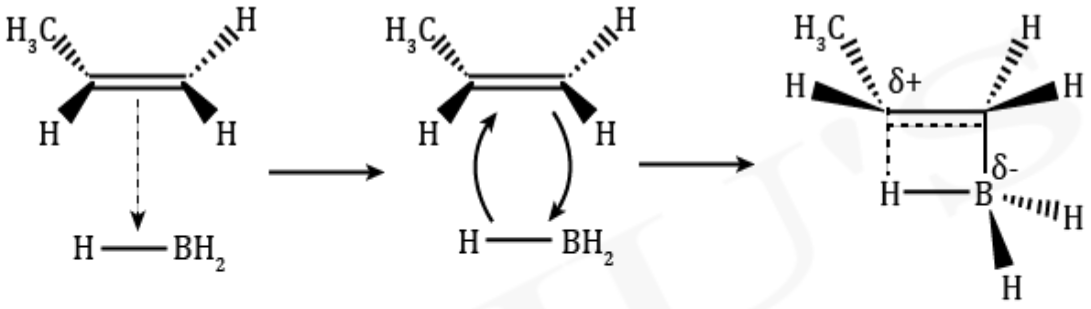
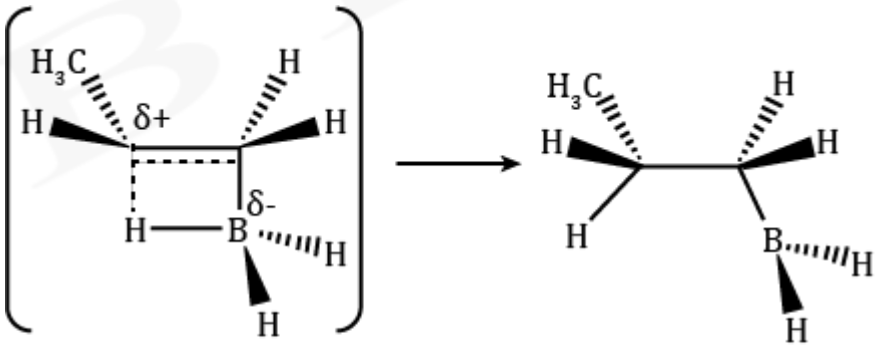


π complex



π complex

4-atom cyclic
Transition state



4-atom cyclic
Transition state

Anti-Markovnikov
addition

DiagramDescription automatically generated with medium confidence

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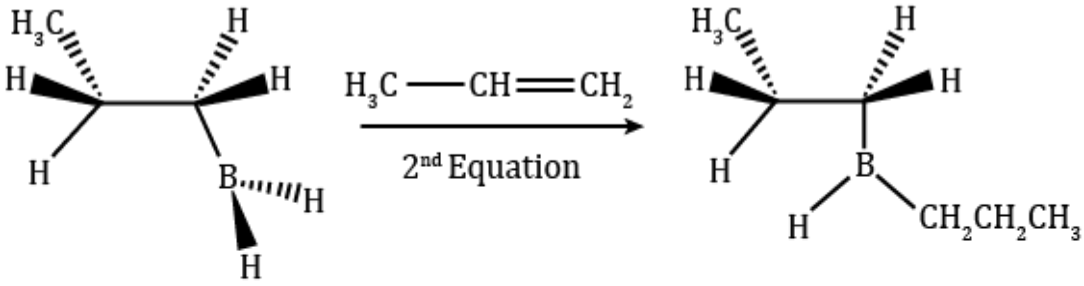
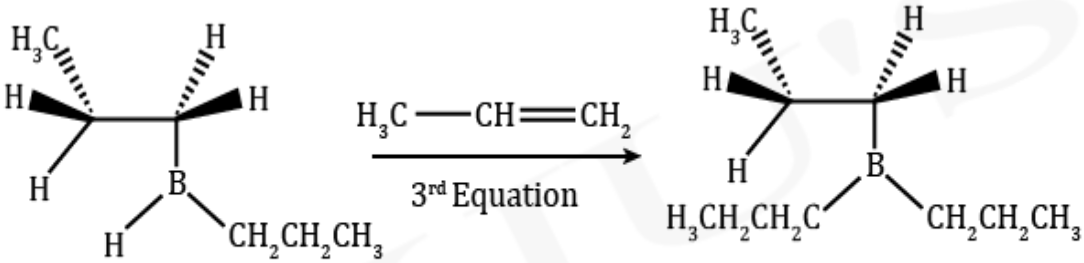
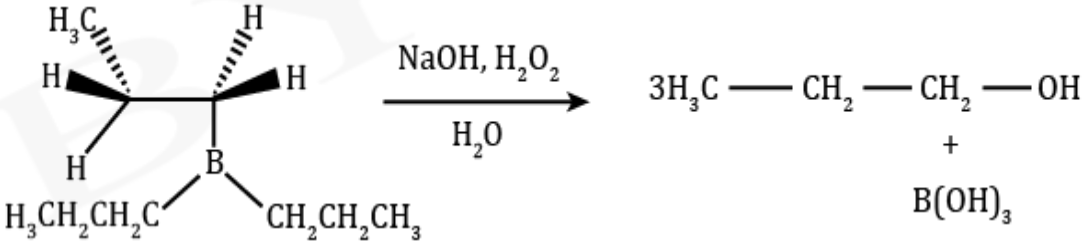


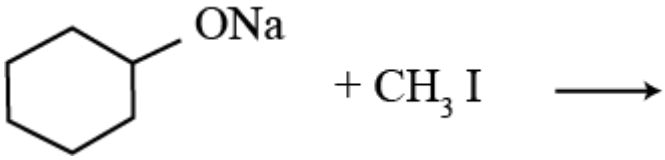
Anti-Markovnikov addition

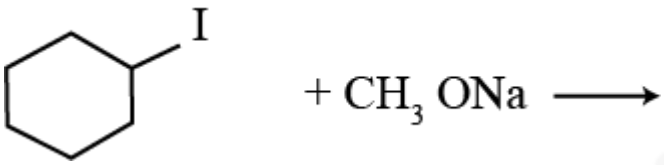


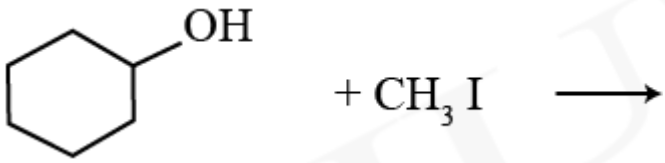


Oxidized product of hydroboration

12. Which of the following reaction is the best choice for preparing methyl cyclohexyl ether?

A. 

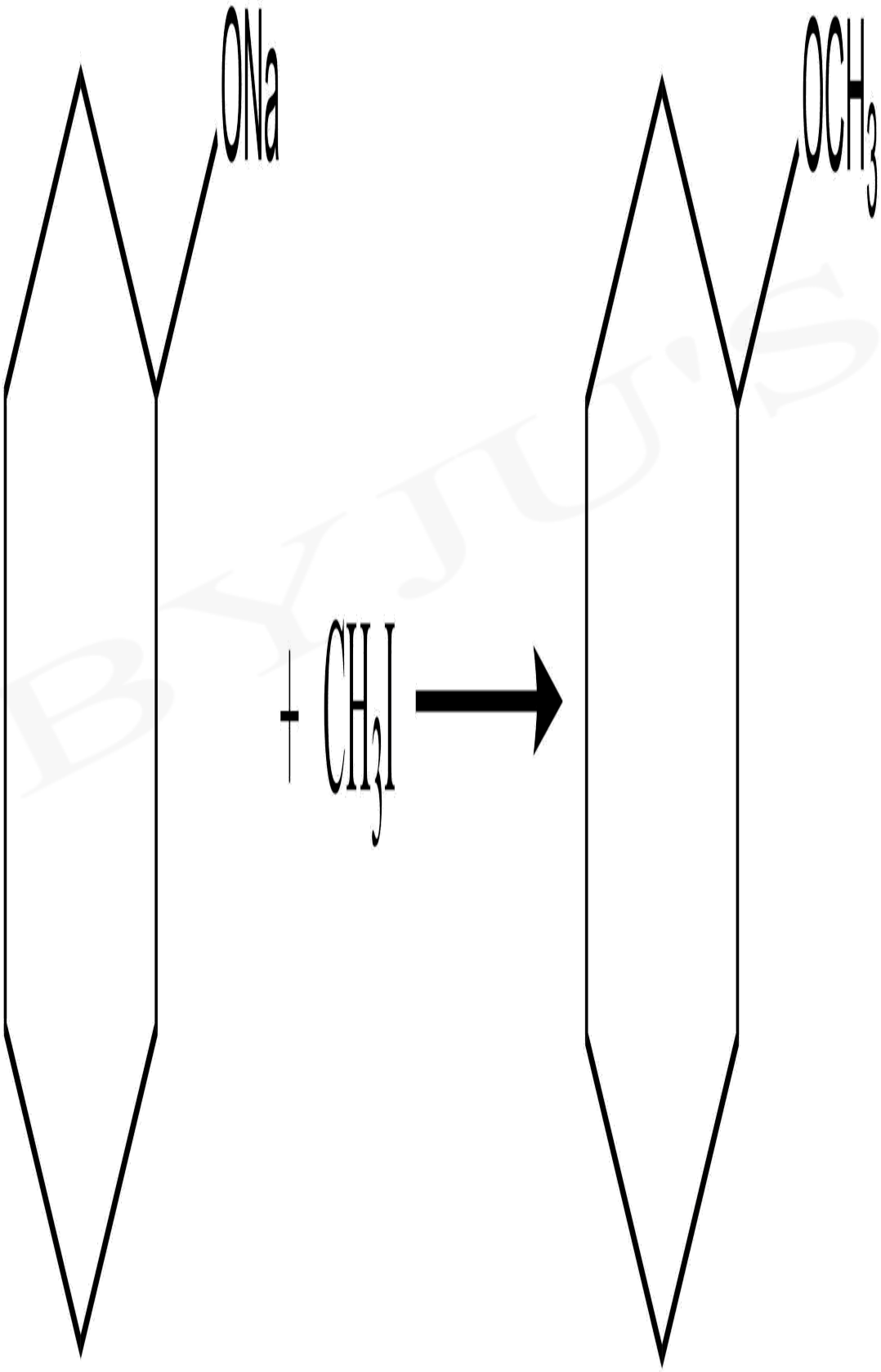
B. 

C. 

D. 

Williamson Ether Synthesis usually takes place as an S_N2 reaction of a primary alkyl halide with an alkoxide ion.
Strong anionic nucleophile and 1° alkyl halide favours S_N2 mechanism. option (a) is the best choice for preparing methyl cyclohexyl

ether.



13. An ethyl alcohol exhibits an acidic character on reaction with :

A. Hydrogen chloride

B. Acetic acid

C. Sodium metal

D. Acidic $K_2Cr_2O_7$

$2C_2H_5O-H+2Na \longrightarrow 2C_2H_5O^-Na^+ + H_2$

Formation of electrovalent compounds (alkoxide) indicates the acidic nature of alcohols on reaction with sodium metal.

Hence, the correct option is (c).

14. Solubility of alcohols and phenols in water is ____ to that of hydrocarbons of comparable molecular masses.

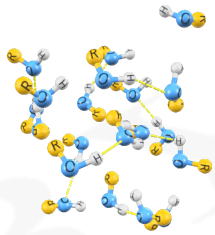
A. Greater than

B. similar

C. lesser than

D. none of these

Since alcohols and phenols can participate in hydrogen bonding while hydrocarbons cannot alcohols are able to interact with water molecules more easily than hydrocarbons of comparable molecular masses. Hence alcohols and phenols possess greater solubility in water than hydrocarbons of comparable molecular masses.



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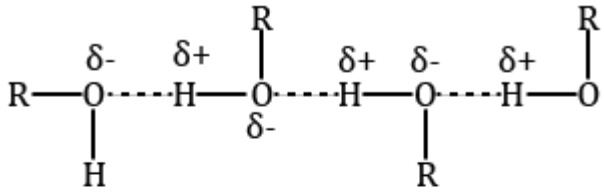
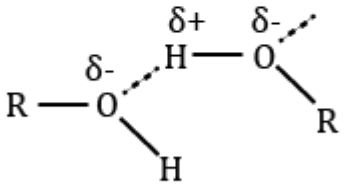
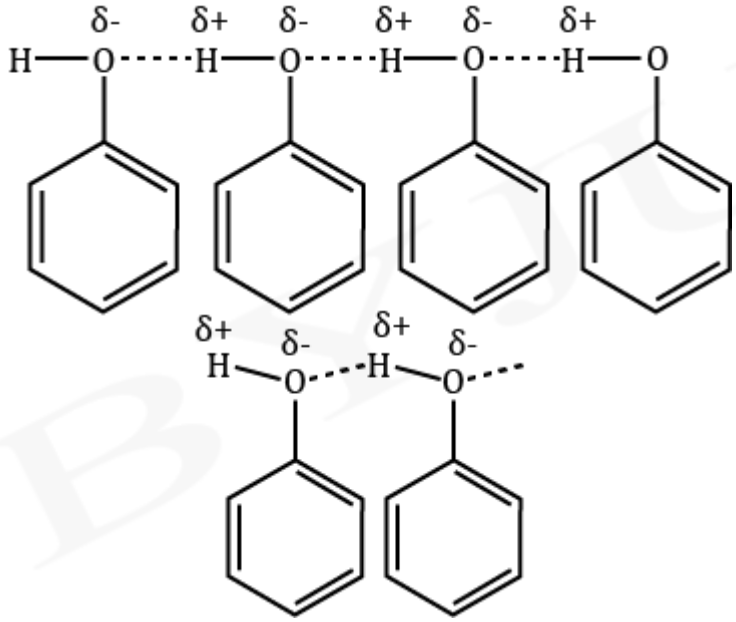
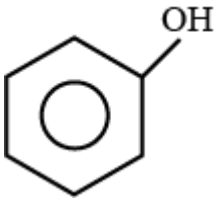


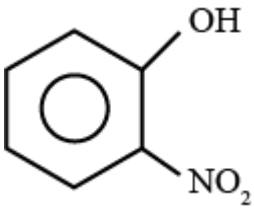


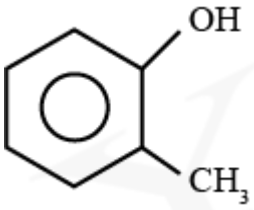


15. Which one of the following compounds is most acidc?

A. $Cl - CH_2 - CH_2 - OH$

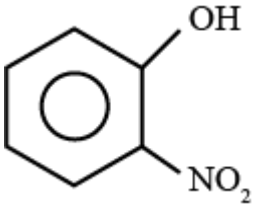
B. 

C. 

D. 

Phenols are more acidic than alcohol & water due to
(i) the higher electronegativity of sp^2 carbon to which OH group is attached.
(ii) the electron withdrawing nature of the benzene ring.

Conjugate base of phenol is stabilised by conjugation of negative charge in the ring. Acidic strength is inversely propotional to EDGs and directly propotional to EWGs.



Hence, it is the most acidic since $-NO_2$ has strong $-I$ and $-R$ effects. So being a strong electron withdrawing group, it makes removal of H^+ easier and makes the phenoxide ion more stable.
Therefore, the correct answer is option (c).

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16. Which of the following is not true regarding the reagent PCC?

A. PCC can oxidize primary alcohols into aldehydes

B. PCC can oxidize aldehydes into carboxylic acids

C. PCC can oxidize secondary alcohols into ketones

D. None of these

PCC is an oxidizing agent that reacts with primary and secondary alcohols. However, it is less reactive than
potassium permanganate and chromic acid. It can oxidize primary alcohols into aldehydes and secondary alcohols into ketones. However, it cannot oxidize aldehydes into carboxylic acids. Hence correct option is (b).

17. In Reimer Tiemann reaction dichlorocarbene acts as:

A. nucleophile

B. electrophile

C. free radical

D. all of these

Reimer Tiemann reaction is an electrophilic substitution reaction.
The first step is :
$CHCl_3 + OH^- \rightleftharpoons H_2O + C^-Cl_3 \rightarrow: CCl_2 + Cl^-$
Dichlorocarbene contains a sextet of electron and thus is a strong electrophile. Hence, the correct answer is option (b).

18. Name the products obtained when hot hydrogen iodide react with benzyl ethyl ether at high temperature?

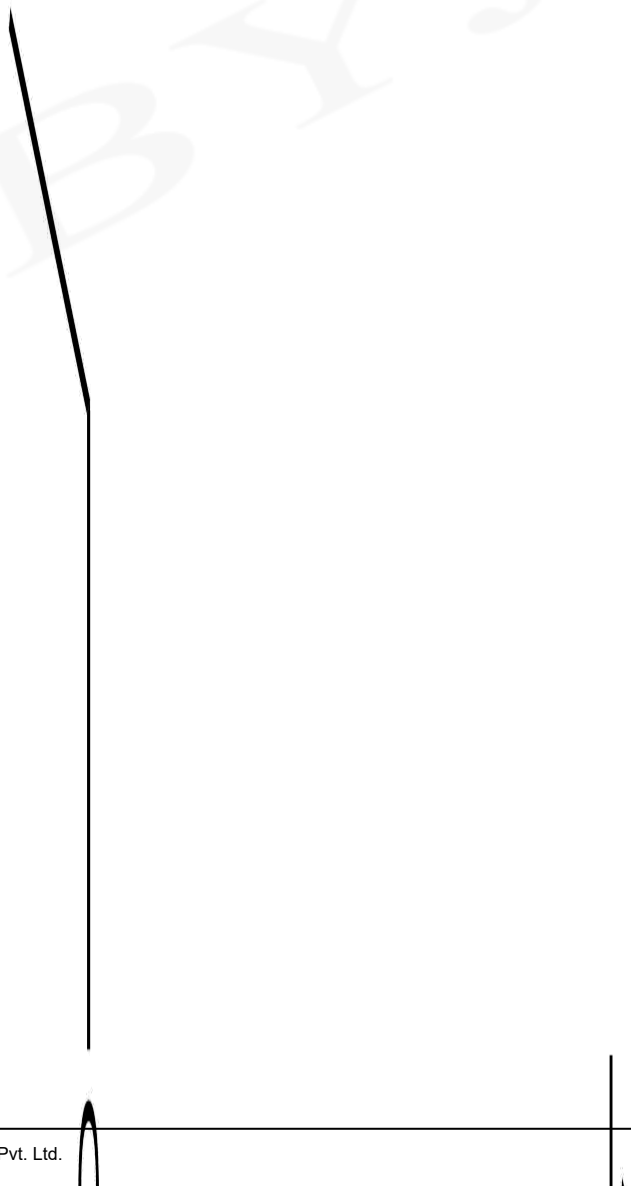
A. Ethanol and Benzyl Iodide

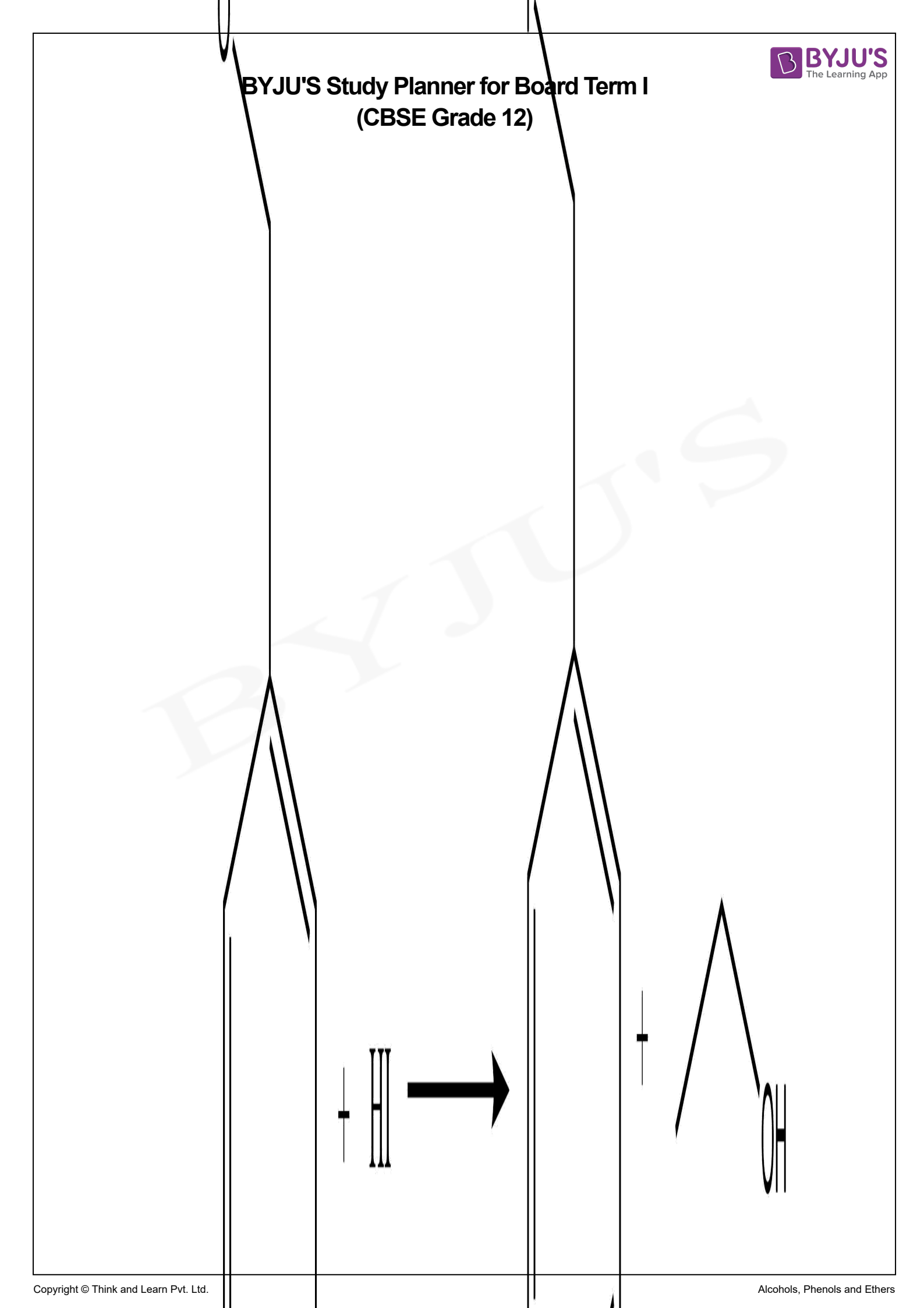
B. Ethyliodide and Benzyl alcohol

C. Ethyliodide and Phenol

D. (a) and (b) above.

Ethers can be reactive under drastic reaction conditions (high temperature, high concentration) due to the cleavage of the C-O bond.
In first step of the reaction, protonation of ether (O) group take place.
In second step, I^- will undergo S_N2 nucleophilic attack.
The reaction of Benzyl ethyl ether is with hot concentrated HI give Ethanol and Benzyl iodide. Hence option (a) is correct. The reaction is as shown below:





Benzene ethyl ether

Benzyl iodide

Ethanol

19. On Friedel-Crafts alkylation, anisole yields major product:

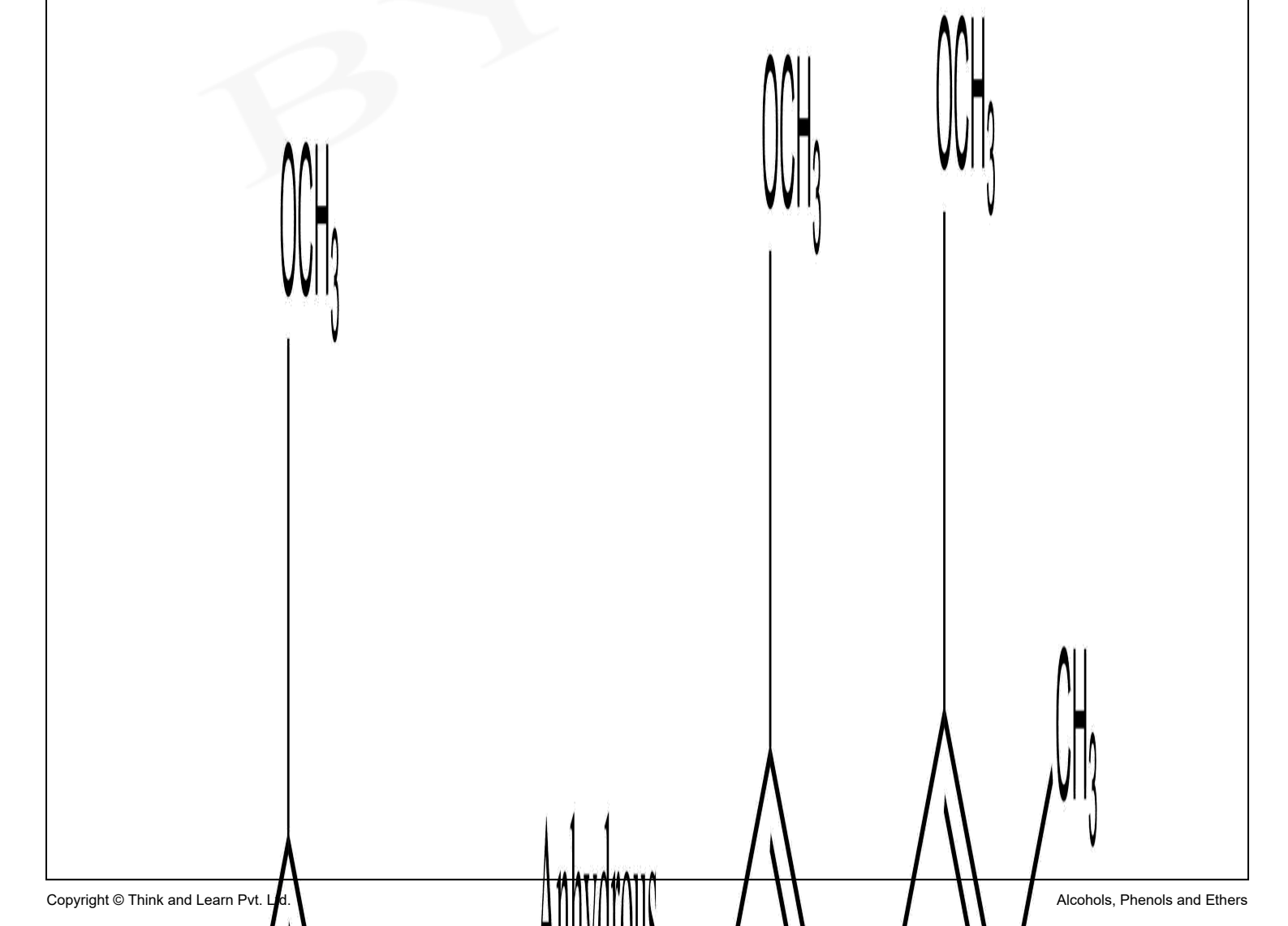
A. 2-Methoxytoluene

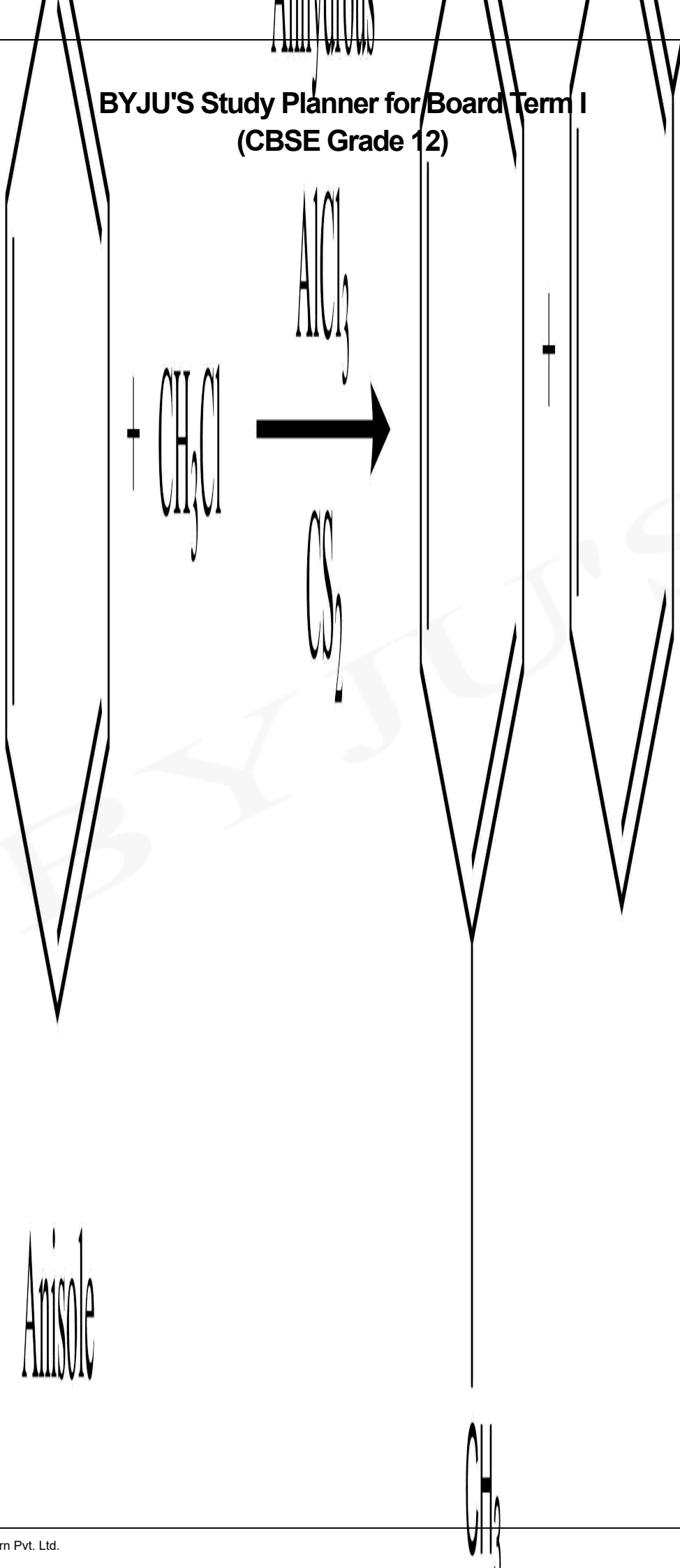
B. 4-Methoxytoluene

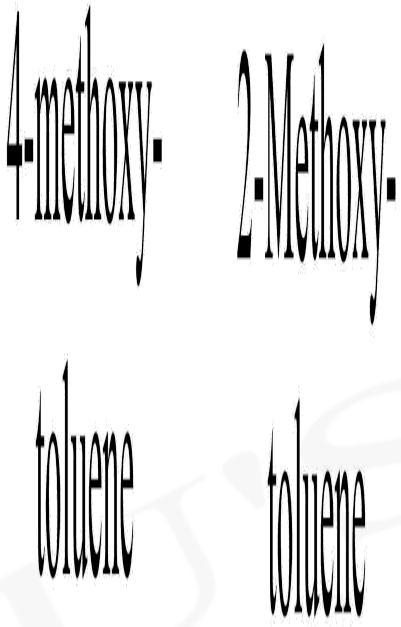
C. 3-Methoxytoluene

D. None of the above

In Friedel craft alkylation, the alkyl chloride will react with anhydrous $AlCl_3$ to form electrophilic carbocation.
Alkoxy benzene will undergo electrophilic aromatic substitution. The ether group will undergo resonating with benzene ring and form resonating structure. In the resonating structures, the electron density at ortho and para position are increased which will attack the electrophile. Ether is ortho/para directing group. Thus, it gives both ortho and para products.
Hence, anisole on alkylation gives 4-Methoxytoluene as a major and 2-Methoxytoluene as a minor product.





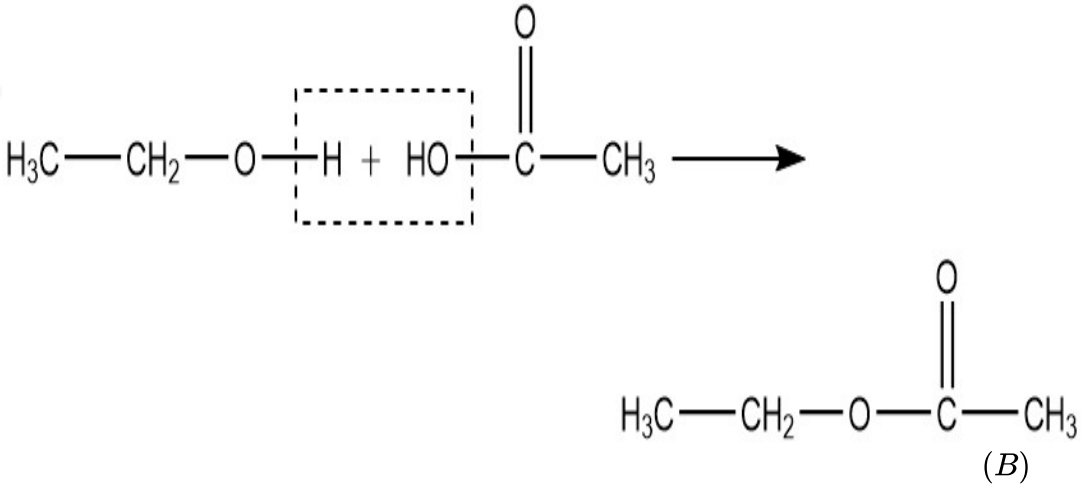


20. $CH_3COOH \overset{LiAiH_4}{\longrightarrow} (A)$,
$(A) + CH_3COOH \overset{H_3O^+}{\longrightarrow} (B) + H_2O$
In the given reaction 'A' and 'B' respectively are ?

- ✗ **A.** $CH_3COOC_2H_5, C_2H_5OH$
- ✗ **B.** CH_3CHO, C_2H_5OH
- ✗ **C.** C_2H_5OH, CH_3CHO
- ✓ **D.** $C_2H_5OH, CH_3COOC_2H_5$

Since $LiAlH_4$ is a reducing agent it will convert CH_3COOH into alcohol (CH_3CH_2OH) and we know that reaction of alcohol and acid leads to the formation of esters hence (B) is $CH_3COOC_2H_5$. The reaction is given below:

$CH_3COOH \overset{LiAlH_4}{\longrightarrow} \underset{(A)}{CH_3CH_2OH}$



(B)

Hence, the correct option is (d).