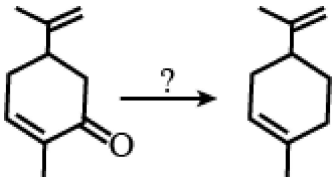
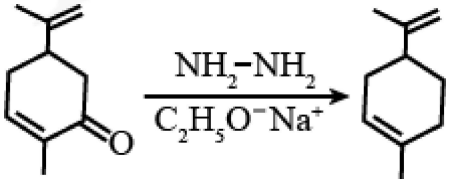
Oxygen containing compounds

1. 

Which of the following reagent is suitable for the preparation of the product in the above reaction?

- **A.** Red $P + Cl_2$
- **B.** Ni/H_2
- **C.** $NaBH_4$
- **D.** $NH_2 - NH_2/C_2H_5\overset{\ominus}{O}\overset{\oplus}{N}a$

In the above reaction, the keto group is reduced to CH_2 and other alkene group are left unaffected.
Ni/H_2 will reduce the alkene to hydrocarbon.
$NaBH_4$ will reduce keto group to secondary alcohol.
$Red\ P + Cl_2$ is a chlorinating agent.
$NH_2 - NH_2/C_2H_5O^-Na^+$ is the reagent of Wolff-kishner reaction. It will reduce keto group to CH_2 group.



Hence, option (d) is the correct answer.

Oxygen containing compounds

2. Which one of the following reactions will not form acetaldehyde?

A. $CH_3CH_2OH \xrightarrow{CrO_3-H_2SO_4}$

B. $CH_2=CH_2+O_2 \xrightarrow[H_2O]{Pd(II)/Cu(II)}$

C. $CH_3CH_2OH \xrightarrow[573\ K]{Cu}$

D. $CH_3CN \xrightarrow[(ii)\ H_2O]{(i)\ DIBAL\text{-}H}$

$CrO_3 - H_2SO_4$ is the Jones reagent, it will oxidise primary alcohol to carboxylic acid and secondary alcohol to ketones.

$$CH_3CH_2OH \xrightarrow[\text{Jones reagent}]{CrO_3-H_2SO_4} CH_3COOH$$

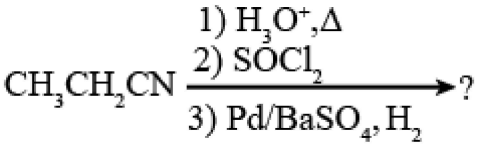
Wacker process:
Oxidation of ethylene to acetaldehyde in the presence of palladium(II) chloride as the catalyst.

When the vapour of ethanol is passed over heated copper catalyst at 573 K , it is dehydrogenated to acetaldehyde.

Di-isobutyl aluminum hydride or DIBAL-H has been used to reduce nitriles and esters into aldehydes.

Hence, option (a) is correct.

3. The major product of the following chemical reaction is:



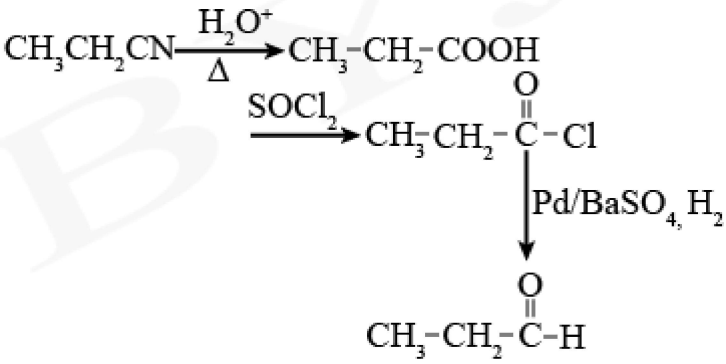
A. $CH_3CH_2CH_3$

B. $CH_3CH_2CH_2OH$

C. CH_3CH_2CHO

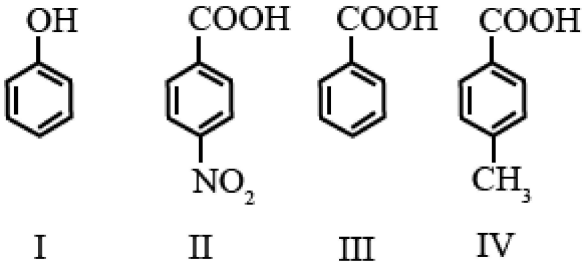
D. $(CH_3CH_2)_2O$

Nitrile is acid hydrolysed to give carboxylic acid and its reaction with $SOCl_2$ gives acid chloriode.
Final step is the Rosenmund reduction.
In this reaction, the aldehyde group is obtained by the reduction of an acid chloride using hydrogen in the presence of Lindlar's catalyst.



Hence, correct option should be (c).

4. The correct order of acid character of the following compounds is :



A. $IV > III > II > I$

B. $II > III > IV > I$

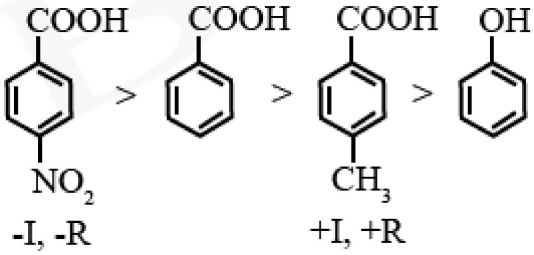
C. $I > II > III > IV$

D. $III > II > I > IV$

Carboxylic acids are more acidic than phenols .

-I and -R effect increase the acidic strength where as +I and +R effect decreases the acidic strength of carboxylic acids.

Acidic strength,



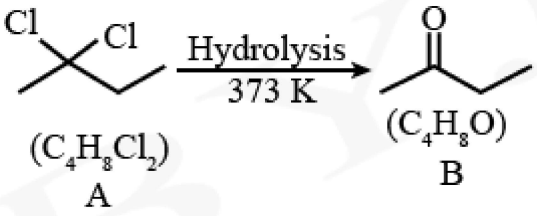
Hence, option (b) is correct.

5. $\underset{(C_4H_8Cl_2)}{A} \xrightarrow[373K]{\text{Hydrolysis}} \underset{(C_4H_8O)}{B}$

B reacts with Hydroxyl amine but does not give Tollen's test. Identify A and B.

- **A.** 2, 2-Dichlorobutane and Butanal
- **B.** 1, 1-Dichlorbutane and Butanal
- **C.** 1, 1-Dichlorobutane and Butan-2-one
- **D.** 2, 2-Dichlorobutane and Butan-2-one

Carbonyl groups reacts with hydroxyl amine but only ketone does not give Tollen's test.
Hence, compound (B) should be a ketone.
Thus, only secondary dihalide (geminal) on hydrolysis gives keto group.



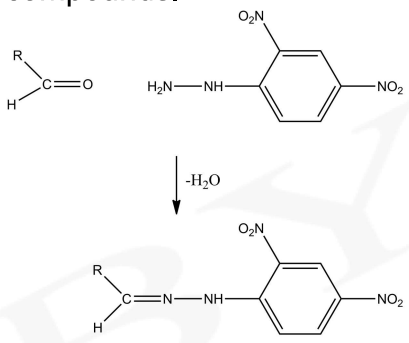
Hence,
A$\rightarrow$ 2, 2-Dichlorobutane
B $\rightarrow$ Butan-2-one

So correct option should be (d).

6. 2, 4-DNP test can be used to identity

- **A.** Aldehyde
- **B.** Amine
- **C.** Ether
- **D.** Halogens

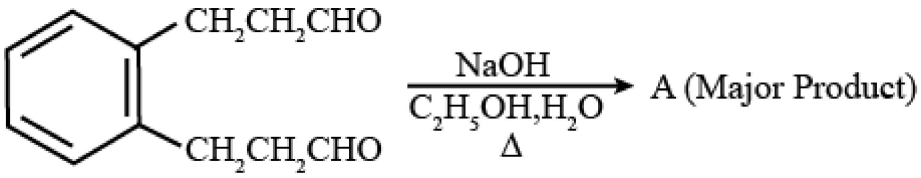
2,4 DNP test to identify $-\overset{\overset{O}{\|}}{C}-$ group. It gives condensation reaction with carbonyl compounds. So, it can be used to identify aldehyde in the given option. It gives yellow/orange precipitate with carbonyl containing compounds.

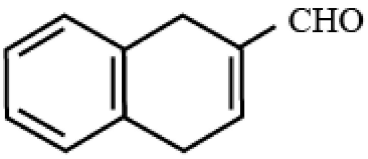


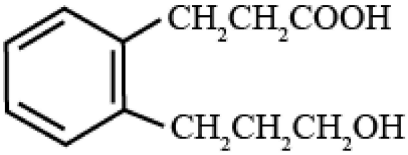
2, 4 Dinitrophenyl hydrazone
(Orange or yellow precipitate)

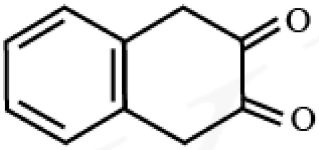
Oxygen containing compounds

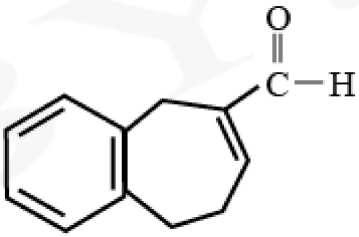
7. Identify A in the given chemical reaction.



✗ **A.** 

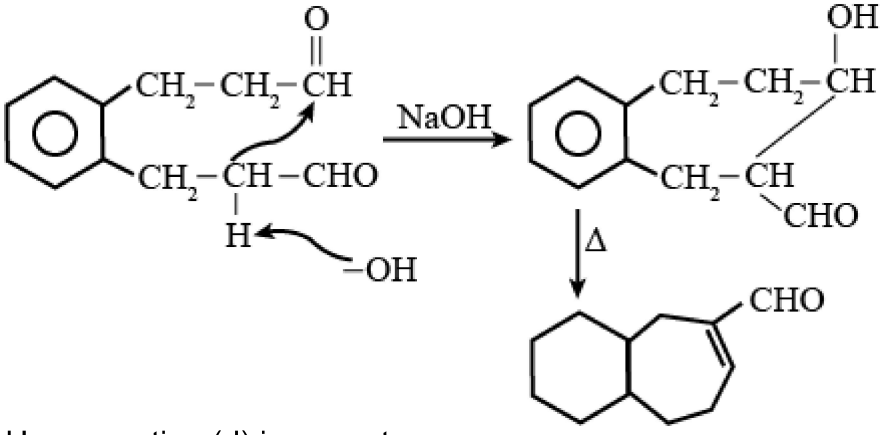
✗ **B.** 

✗ **C.** 

✓ **D.** 

Aldehyde with alpha hydrogens undergoes aldol condensation in presence of dilute base followed by removal of water molecule during heating.

In the given molecule, there are two symmetrical aldehyde group so it will undergoes intramolecular aldol condensation followed by condensation reaction to give conjugated enone as given below:



Hence, option (d) is correct.

8. Assertion A : Enol form of acetone $[CH_3COCH_3]$ exists in < 0.1% quantity. However, the enol form of acetyl acetone $[CH_3COCH_2OCCH_3]$ exists in approximately 15% quantity.

Reason R : Enol form of acetyl acetone is stabilized by intermolecular hydrogen bonding, which is not possible in enol form of acetone.

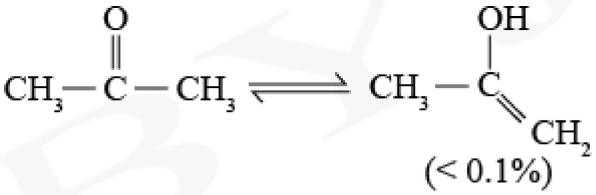
Choose the correct statement :

A. A is false but R is true

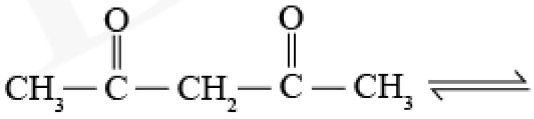
B. Both A and R are true and R is the correct explanation of A

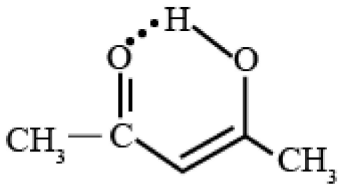
C. A is true but R is false

D. Both A and R true but R is not the correct explanation of A



(< 0.1%)



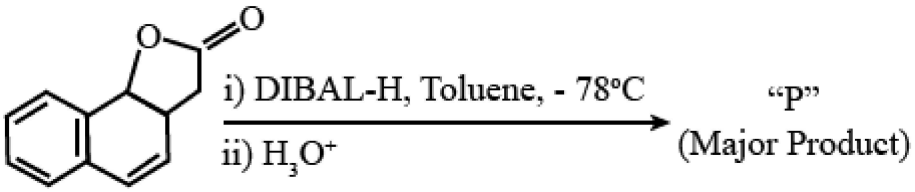


Intramolecular
H-bonding
(= 15%)

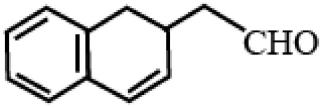
Acetyl acetone in enol form have intramolecular H-bonding, which is absent in acetone.
Hence, enol formed from acetyl acetone is more stable than enol form of acetone.
Hence, option (b) is the correct answer.

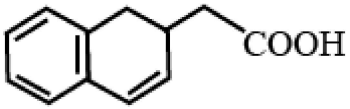
Oxygen containing compounds

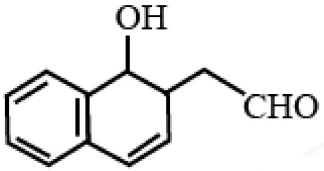
9.

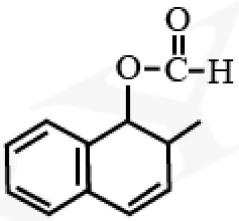


The product "P" in the above reaction is :

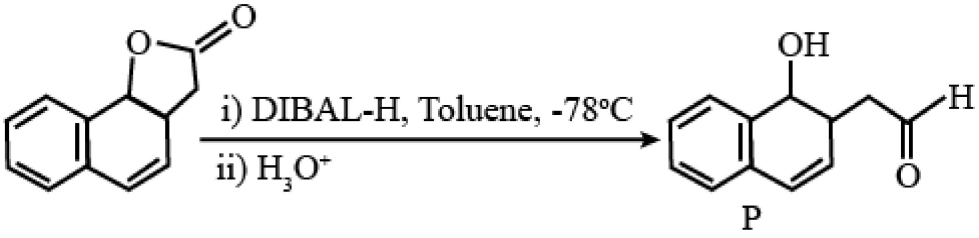
✗ **A.** 

✗ **B.** 

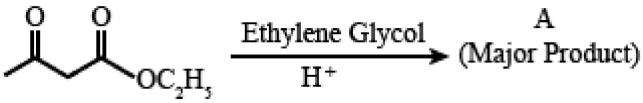
✓ **C.** 

✗ **D.** 

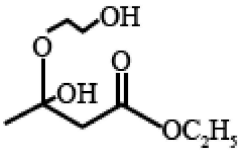
DIBAL-H - diisobutylaluminium hydride selectively reduces nitriles and esters to aldehydes.
The reaction is usually carried out at -78^oC to prevent reaction with the aldehyde product.
Also the tetrahedral intermediate formed by DIBAL with ester is stable only at -78^oC.

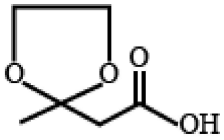


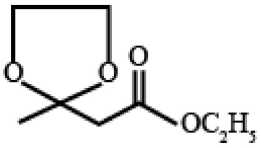
Hence, option (c) is the correct answer.

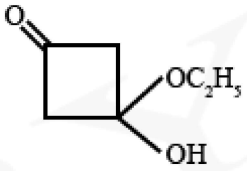
10. 

the product " A " in the above reaction is

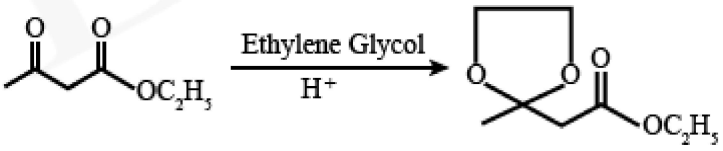
✗ **A.** 

✗ **B.** 

✓ **C.** 

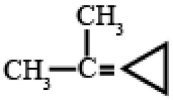
✗ **D.** 

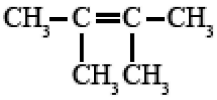
Ethylene glycol in presence of H^+ will convert ketone into cyclic ketal and the ester group remains intact.



Hence, option (c) is correct.

11. An unsaturated hydrocarbon X on ozonolysis gives A. Compound A when warmed with ammonical silver nitrate forms a bright silver mirror along the sides of the test tube. The unsaturated hydrocarbon X is :

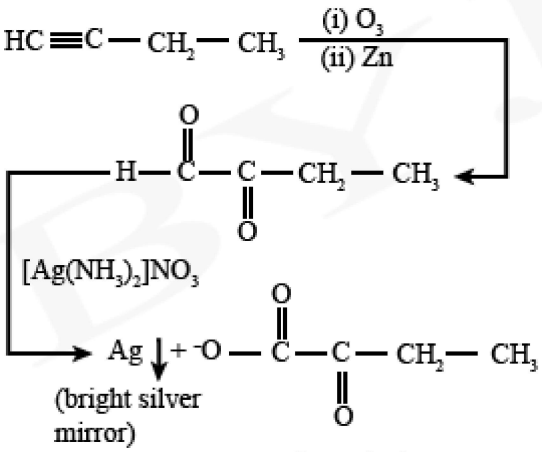
A. 

B. 

C. $CH \equiv C - CH_2 - CH_3$

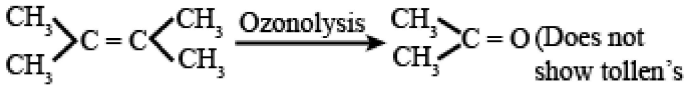
D. $CH_3 - C \equiv C - CH_3$

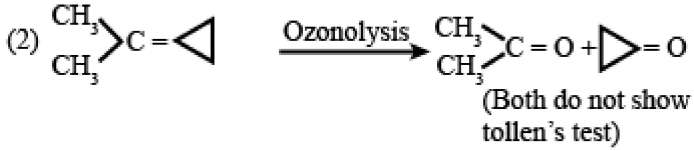
The product 'A' from ozonolysis of X gives silver mirror test with tollen's reagent. Hence, 'A' should be a aldehyde or HCOOH or α-hydroxy ketone.



(3) $CH_3-CH_2-C\equiv CH \xrightarrow{\text{Ozonolysis}} CH_3CH_2COOH + HCOOH$

(A)
+Ve tollen's test

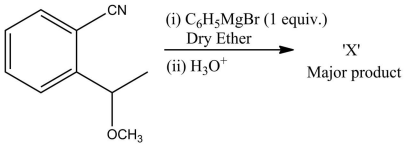
(1) 

(2) 

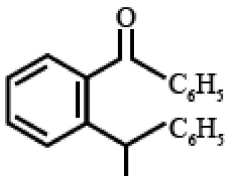
(3) $CH_3-C\equiv C-CH \xrightarrow{\text{Ozonolysis}} 2CH_3-COOH$

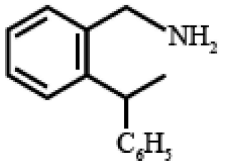
(Does not shown tollen's test)

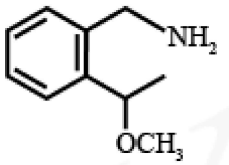
Hence, option (c) is correct.

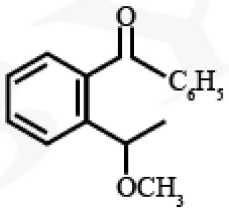
12. 

The structure of X is :

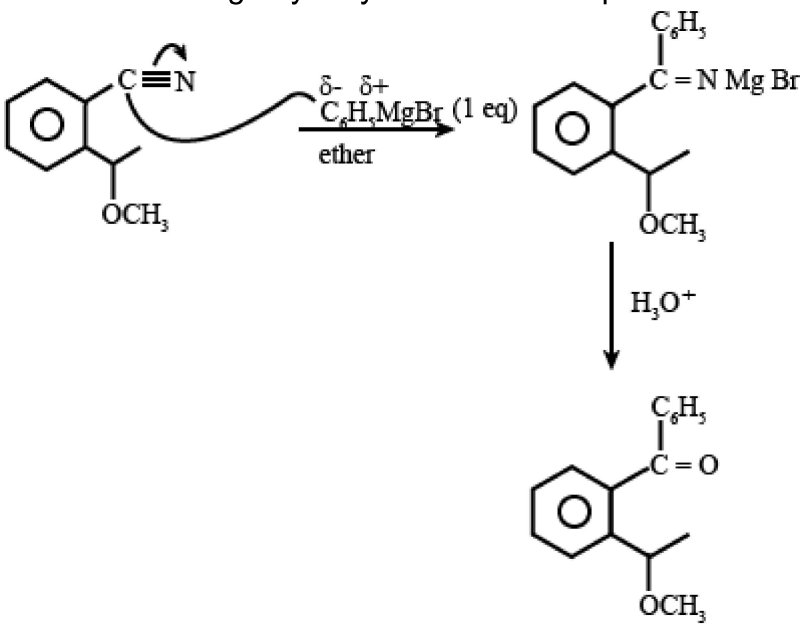
A. 

B. 

C. 

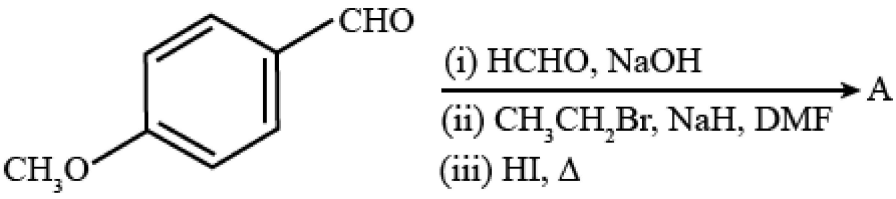
D. 

When nitriles react with grignard reagent R^- from the grignard will undergo nulceophilic addtion reaction to form imine product.
Imine will undergo hydrolysis to form keto product.

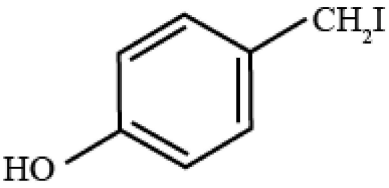


Hence, option (d) is correct.

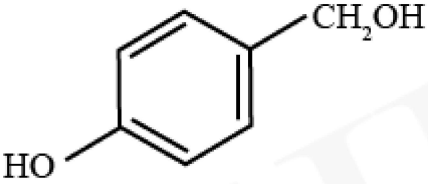
13. Identify A in the following chemical reaction.



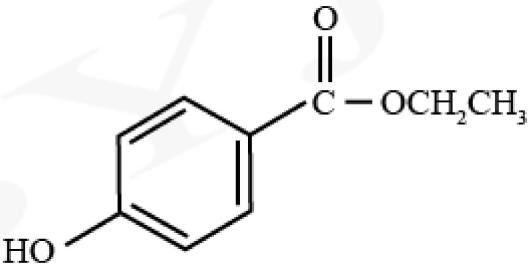
✔ **A.**



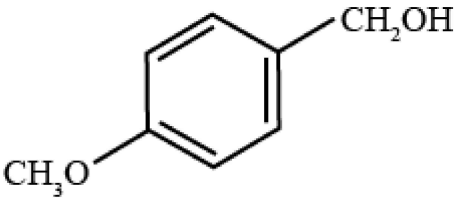
✘ **B.**



✘ **C.**



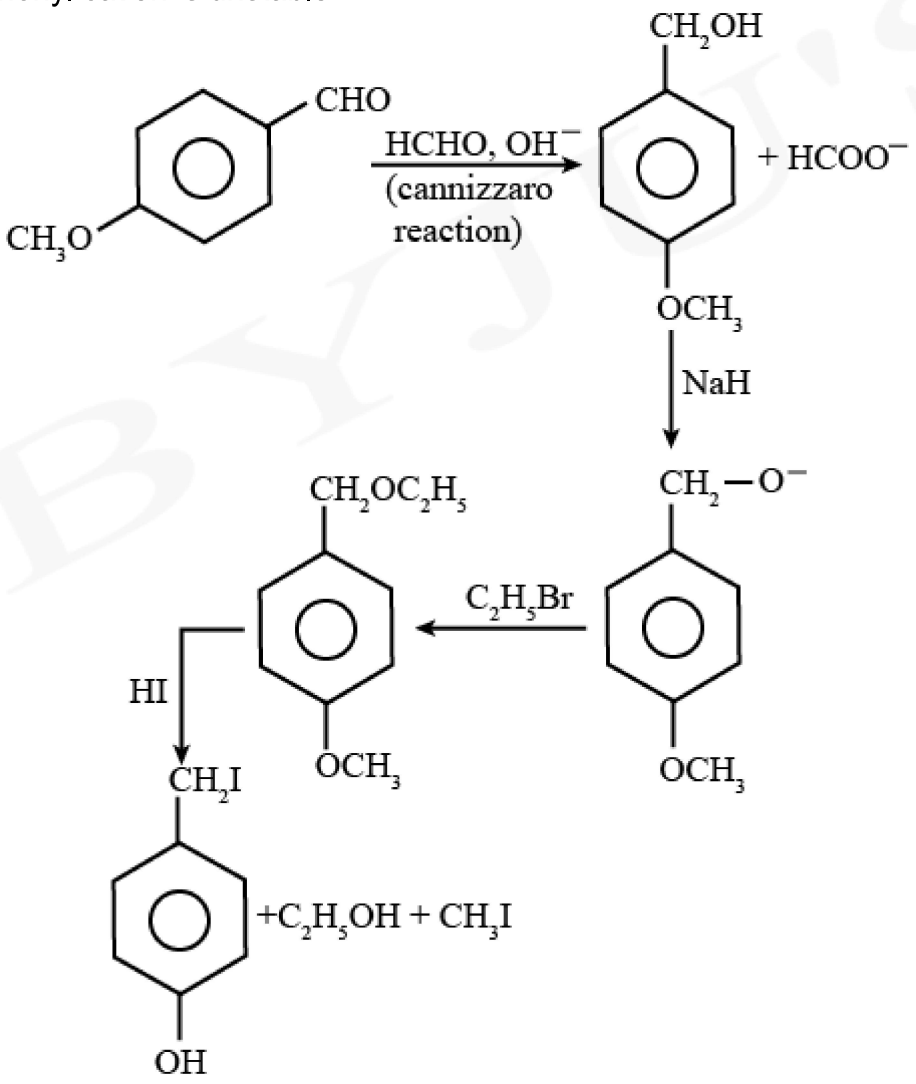
✘ **D.**



Oxygen containing compounds

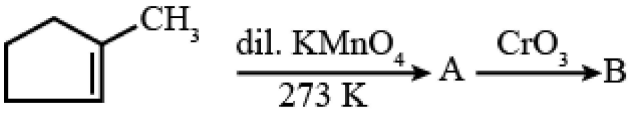
Aldehydes which does not have α-Hydrogen undergoes cannizzaro reaction.
In crossed cannizzaro reaction, aldehyde which has less steric and highly positive carbonyl carbon undergoes oxidation and other will undergo reduction.
In second step, the alcohol group gets depronated by H^- from NaH and followed by S_N2 reaction to form ether compound.

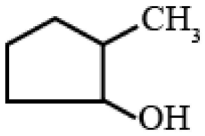
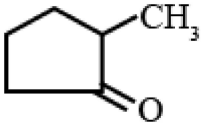
In final step, ether on reaction with HI undergoes S_N2 or S_N1 reaction depends on the nature substrate.
Benzylic cation is highly stable so it undergoes S_N1 to form the major product.
Also, at another position, ether cleavage occurs by S_N2 reaction since, phenyl cation is unstable.

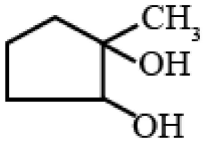
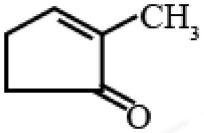


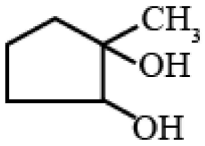
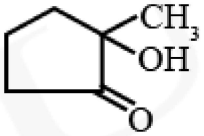
Hence, option (a) is correct.

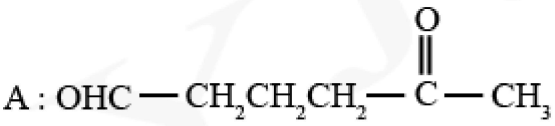
14. Identify products A and B.

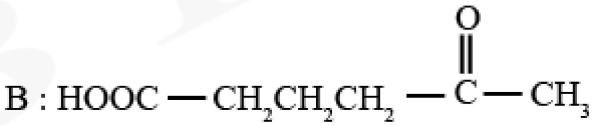


A. A :  B : 

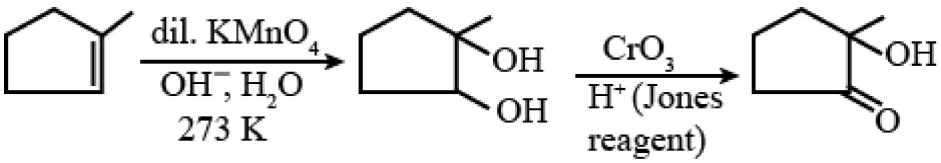
B. A :  B : 

C. A :  B : 

D. A : 

B : 

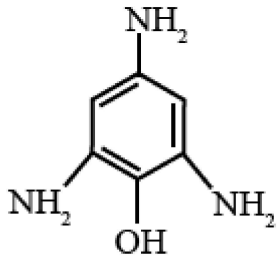
Reaction of alkene with dil. $KMnO_4$ gives 1,2 diol (vicinal diol).
Jones reagent, CrO_3 oxidise primary alchol to carboxylic acid and secondary alcohol to ketone.
3^o-alcohols do not undergo oxidation reaction easily.



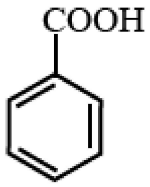
Hence, option (c) is correct.

15. Compound(s) which will liberate carbon dioxide with sodium bicarbonate solution is/are :

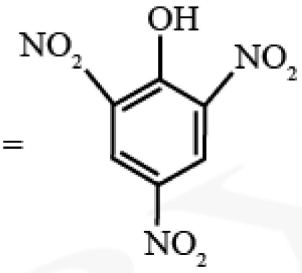
A =



B =



C =



A. B only

B. C only

C. A and B only

D. B and C only

Oxygen containing compounds

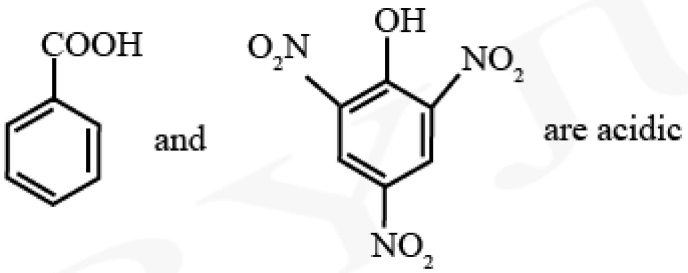
Compounds which have higher acidic strength than conjugate acid of sodium bicarbonate (i.e., carbonic acid) will react with $NaHCO_3$ to produce CO_2.
Phenol is a weak acid than carbonic acid so it cannot decompose $NaHCO_3$.
Generally, all those acids which are more acidic than phenol will release CO_2 on reaction with $NaHCO_3$.

Due to -R effect of NO_2 it will withdraw the electron density toward themself so the ease of removal of H^+ is increased so it more acidic than phenol so it will react with sodium bicarbonate to give CO_2

Benzoic acid is stronger than phenol so it also liberate CO_2 with $NaHCO_3$ solution.

NH_2 are +R effect group, it increase the electron density on OH and make them less acidic than phenol.

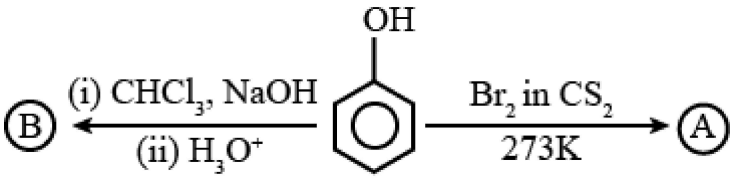
Thus,

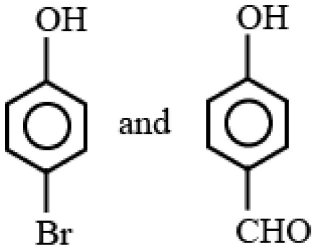


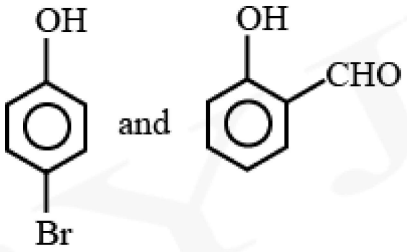
are acidic

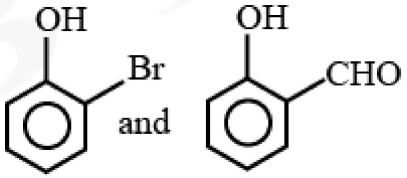
enough to liberate CO_2 with $NaHCO_3$ solution.
Hence, option (d) is correct.

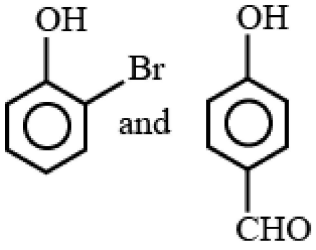
16. Identify the major products A and B respectively in the following reactions of phenol:



✗ **A.** 

✓ **B.** 

✗ **C.** 

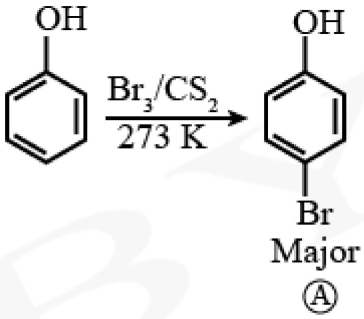
✗ **D.** 

Oxygen containing compounds

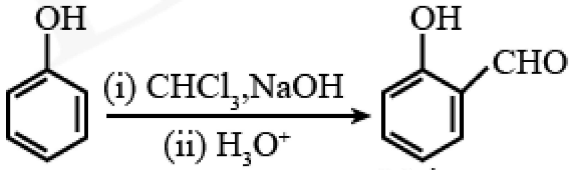
Product A:
Phenol undergoes bromination in CS_2 to give para-bromophenol. Though OH is a ortho/para directing group, para product is major due to the less steric hindrance.

Product B:
It is a Reimer-Tiemann reaction. In this reaction, phenol gets converted to salicylaldehyde in the presence of $CHCl_3 + Aq.NaOH$ followed by hydrolysis.
It is an electrophilic substitution reaction, reaction intermediate dichloro carbene is formed and acts as an electrophile.

In the Reimer-Tiemann reaction, the phenoxide ion formed will show mesomeric and inductive effect hence, the reaction might take place at ortho or para position. But as we know, +I-effect decreases with increasing distance, therefore the ortho position will be electron rich and the incoming electrophile will attack at the ortho position. Therefore, formylation will take place at the ortho position.



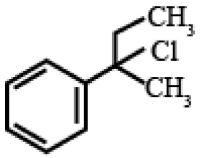
Major
Ⓐ

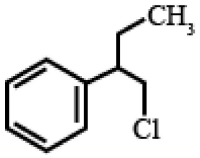


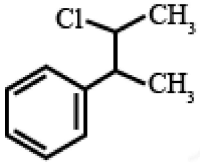
Major
Ⓑ

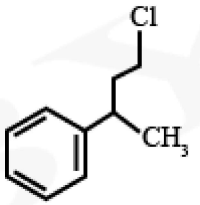
So option (b) is the correct answer

17. Reaction of Grignard reagent, C_2H_5MgBr with C_8H_8O followed by hydrolysis gives compound "A" which reacts instantly with Lucas reagent to give compound B, $C_{10}H_{13}Cl$.
Compound (B) is

A. 

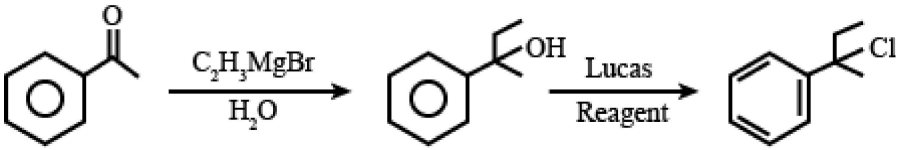
B. 

C. 

D. 

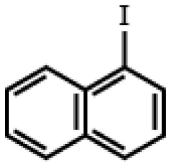
The reaction of alcohol with Lucas reagent $(\text{conc. } HCl + \text{anhyd. } ZnCl_2)$ is mostly S_N1 reaction and the rate of reaction is directly proportional to the stability of carbocation formed in the reaction.
Since, 3^o alcohol forms 3^o carbocation (most stable) hence, it will react fastest by S_N1 reaction to give tertiary halide.

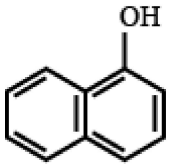
Thus, compound (A) is a tertiary alcohol.
Since C_2H_5MgBr with C_8H_8O followed by hydrolysis gives tertiary alcohol, the starting compound is a keto compound.
Hence, with help of molecular formula, the above reaction is given below:

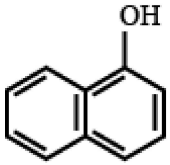


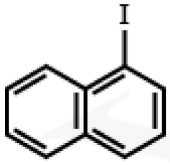
Hence, option (a) is correct.

18. Main products formed during a reaction of 1-methoxy naphthalene with hydroiodic acid are :

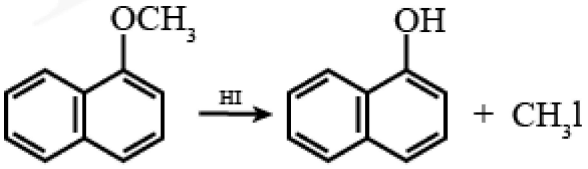
A.  and CH_3OH

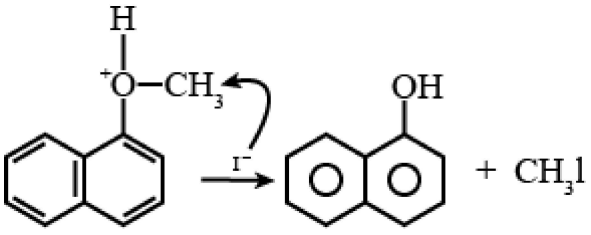
B.  and CH_3OH

C.  and CH_3I

D.  and CH_3I

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, S_N2 reaction take place, where I^- nucleophile will attack the less hindered site to form methyl iodide and naphthol.

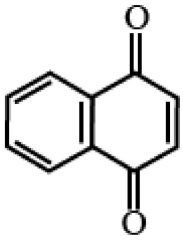


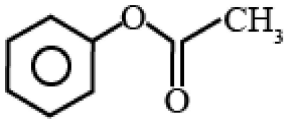


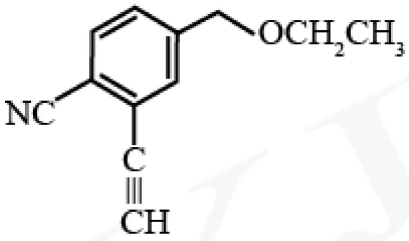
Hence, option (c) is correct.

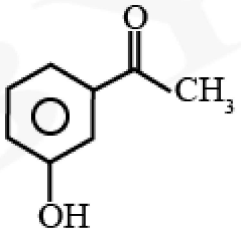
Oxygen containing compounds

19. Which one of the following compounds does not give a tertiary alcohol on reaction with excess of CH_3MgBr followed by hydrolysis?

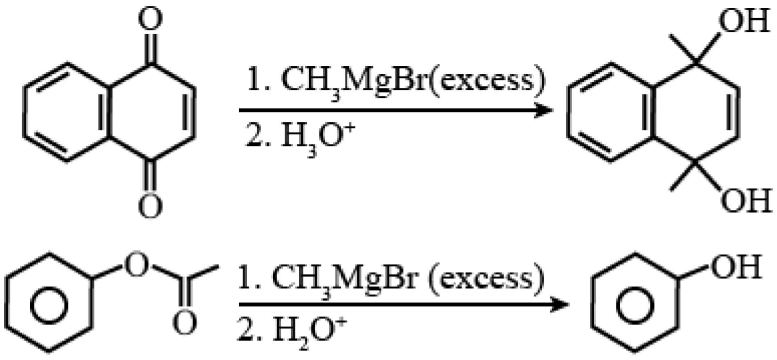
A. 

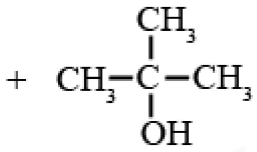
B. 

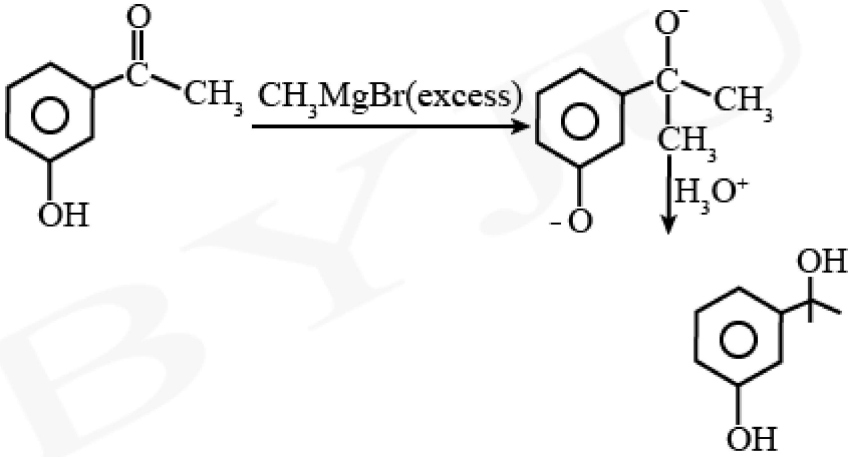
C. 

D. 

Oxygen containing compounds



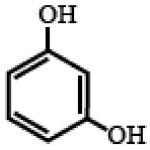


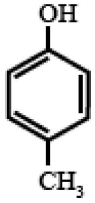


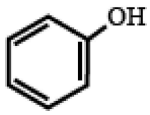
Compound (c) does not give a tertiary alcohol product with excess grignard reaction. CH_3^- from grignard reagent act as a base and accept the acidic hydrogen from alkyne on reaction with (c).

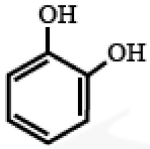
Hence, option (c) is correct.

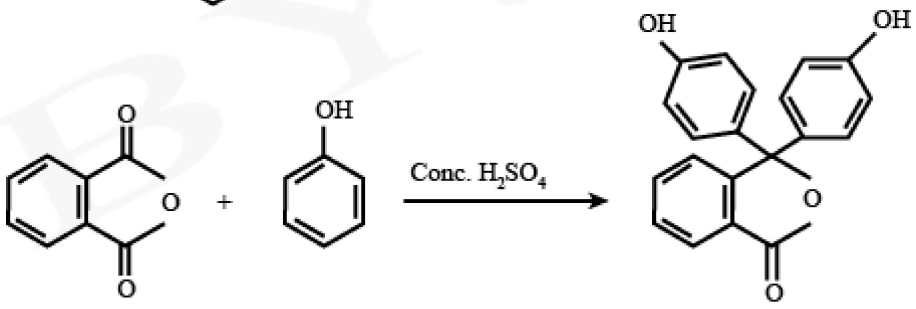
20. Which one of the following phenols does not give colour when condensed with phthalic anhydride in presence of $conc.\ H_2SO_4$?

A. 

B. 

C. 

D. 



Phthalic anhydride Phenolphthalein

As phthalic anhydride being bulky, electrophilic substitution reaction occurs at para position in phenol or its derivatives

Compound (b) does not condense with phthalic anhydride because para position is blocked.

Hence, option (b) is correct.

Oxygen containing compounds

21. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Synthesis of ethyl phenyl ether may be achieved by Williamson synthesis.
Reason (R) : Reaction of bromobenzene with sodium ethoxide yields ethyl phenyl ether.
In the light of the above statement. choose the most appropriate answer from the options given below:

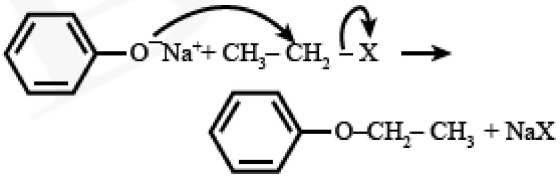
✗ **A.** (A) is not correct but (R) is correct

✓ **B.** (A) is correct but (R) is not correct

✗ **C.** Both (A)~ and ~(R) correct but (R) is NOT the correct explanation of (A)

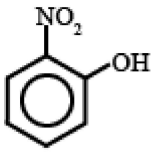
✗ **D.** Both (A) and (R) are correct and (R) is the correct explanation of (A)

Assertion is correct

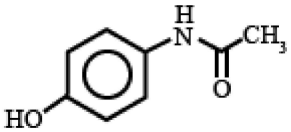


But the reason is not correct because $aryl$ halides do not undergo nucleophilic substitution reactions.

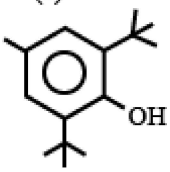
22. The compound/s which will show significant intermolecular H-bonding is/are



(a)



(b)



(c)

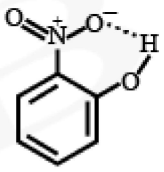
✗ **A.** (a) and (b)

✗ **B.** (c) only

✗ **C.** (a), (b) and (c)

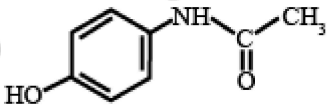
✓ **D.** (b) only

(a)



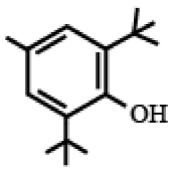
Intramolecular H-bonding

(b)



Intramolecular H-bonding is not possible here. So, intermolecular H-bonding is Prominent

(c)

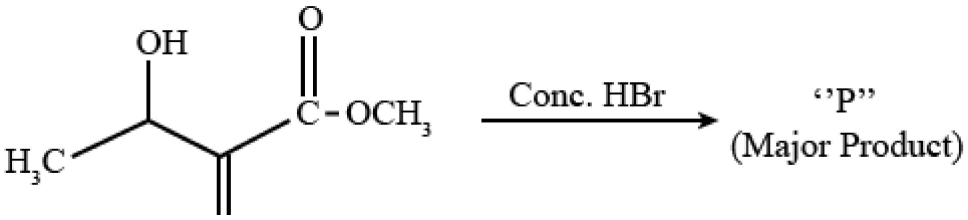


Because of large steric crowding, intermolecular H-bonding is difficult

Hence, option (d) is correct.

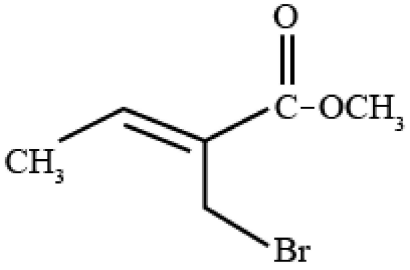
Oxygen containing compounds

23.

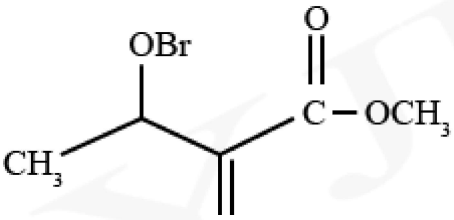


Consider the above reaction, the major product "P" formed is,

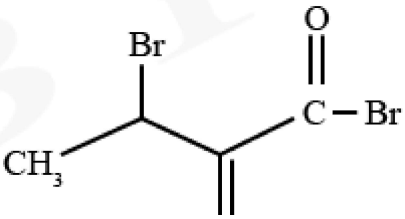
✔ **A.**



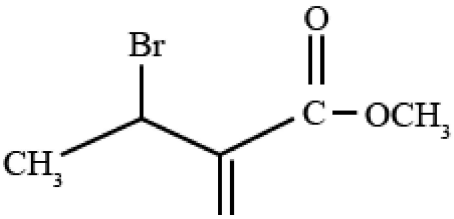
✘ **B.**



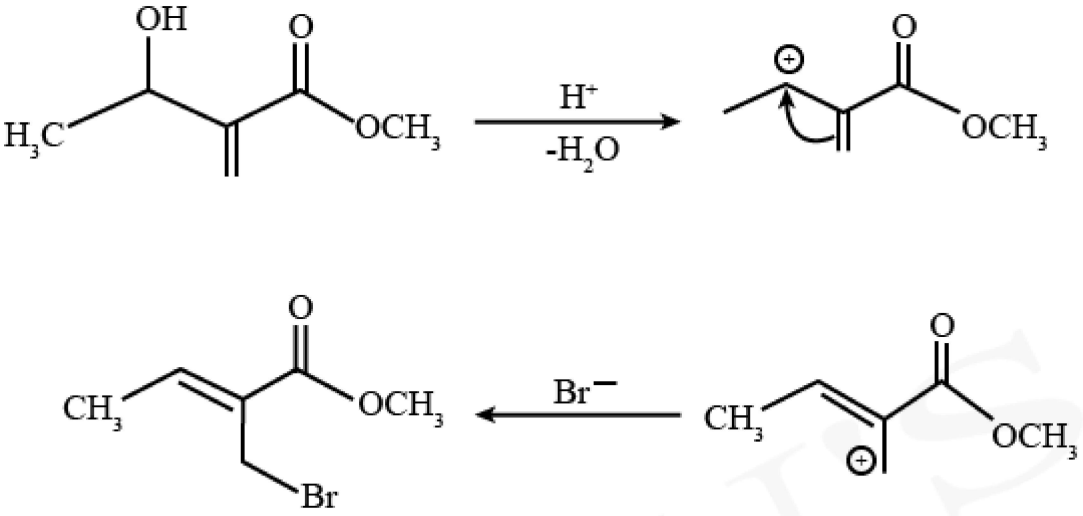
✘ **C.**



✘ **D.**



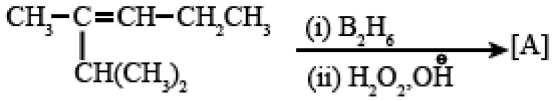
In this reaction, the OH group will attack the H^+ and get removed as water molecule to give a carbocation which undergoes resonance to form a stable more substituted alkene followed by addition of Br^-.

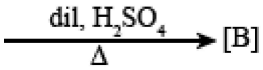


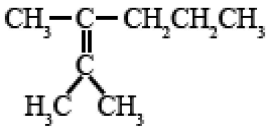
(Major)

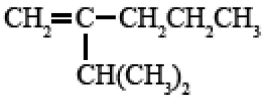
Hence, option (a) is correct.

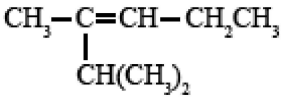
24. The major product [B] in the following sequence of reaction is

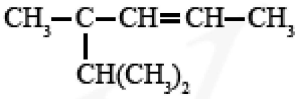




✔ **A.** 

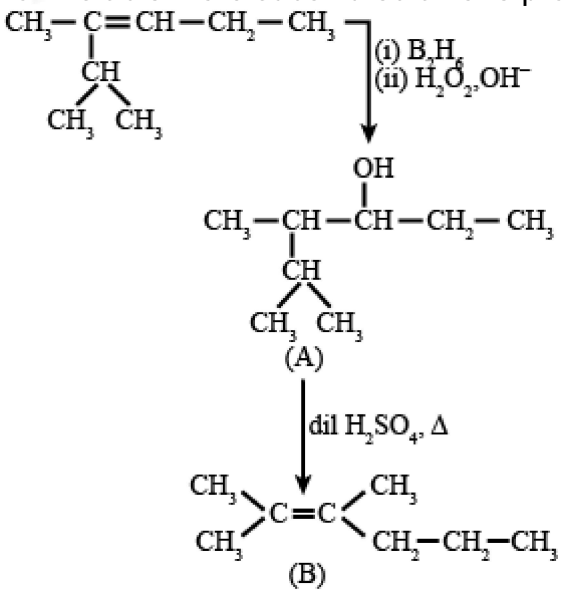
✘ **B.** 

✘ **C.** 

✘ **D.** 

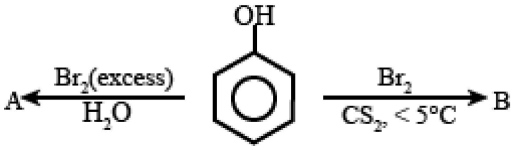
In hydroboration of alkene, the OH group get attached to the alkene carbon which is less substituted.

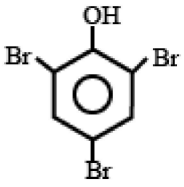
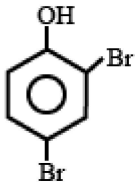
The formed alcohol product in presence of $dil.\ H_2SO_4$ abstact a proton and get removed as water molecule to form secondary carbocation. It undergoes 1, 2 H-shift to form stable tertiary carbocation followed by deprotonation to form stable more substituted alkene product (Saytzeff product).

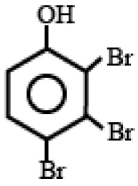
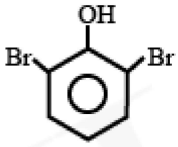


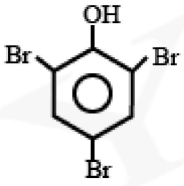
Hence, option (a) is correct.

25. The correct options for the products A and B of the following reactions are :



A. A =  , B = 

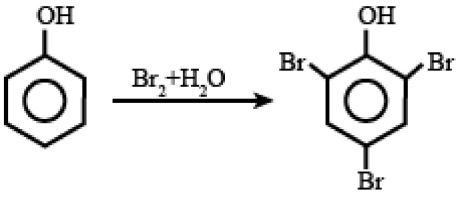
B. A =  , B = 

C. A =  , B = 

D. A =  , B = 

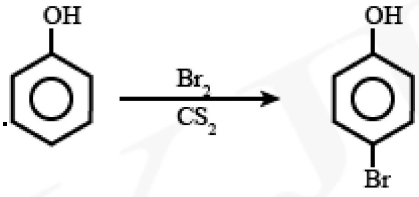
Oxygen containing compounds

Product A:
In the water solvent when phenol treated with Br_2 gives a polybromo derivative in which all hydrogen atoms at ortho, meta, and para positions with respect to the −OH group are replaced by bromine atoms. It is so because in aqueous medium phenol ionizes to form peroxide ion. Due to the presence of negative ions the ring gets highly activated and tri substitution occurs and the formation of 2,4,6 – tribromophenol takes place.



(A)

Product B:
Phenol undergoes bromination in CS_2 to give para-bromophenol. Though OH is a ortho/para directing group, para product is major due to the less steric hindrance.



(B)

Hence, option (c) is correct.