



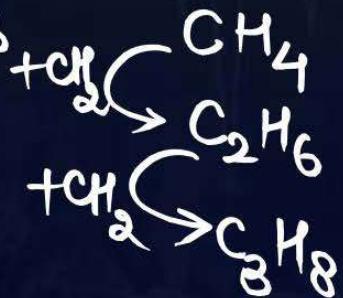
General Introduction



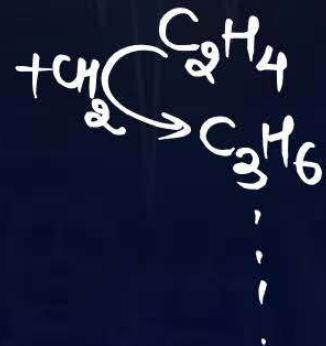
Alkane



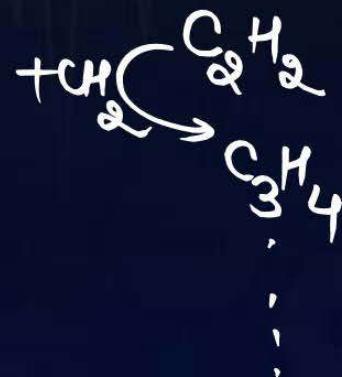
Homo
series



Alkene



Alkyne



Benzene

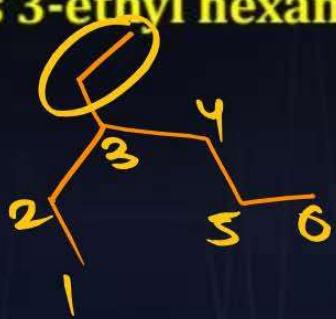
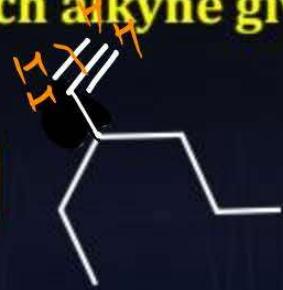




Methods of Preparation of Alkanes

1. From Unsaturated hydrocarbons:



C.Q. 1**Which alkyne gives 3-ethyl hexane on catalytic hydrogenation?****A****B****C**

Both (A) & (B)

D

None of these

2. From Alkyl halides: [R-X]

A. Wurtz Reaction:



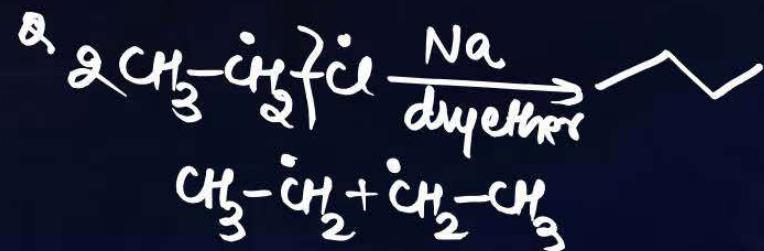
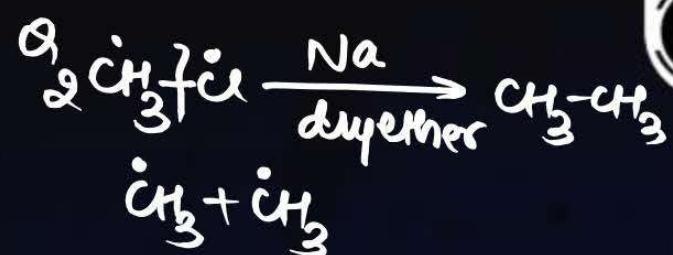
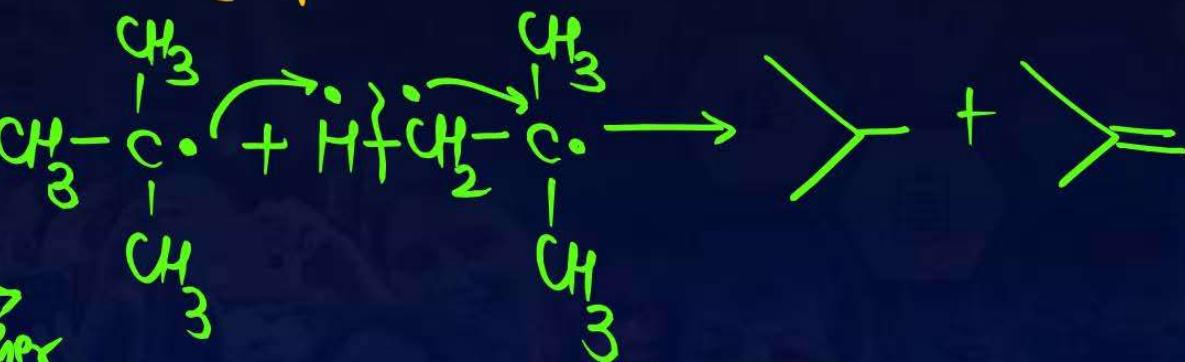
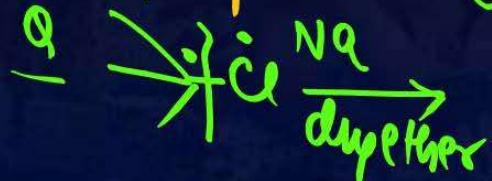
even no of 'C'

(symmetrical alkane)

at point

1° & 2° coupling

3° dispropor



C.Q. 2 [NEET 2020]



Which of the following alkane cannot be made in good yield by Wurtz reaction?

A 2, 3-Dimethylbutane



B n-Heptane ^{odd}



C n-Butane



D n-Hexane



C.Q. 3 [NEET 2018]

P
W

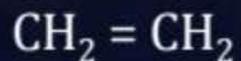


Hydrocarbon (A) reacts with bromine by substitution to form an alkyl bromide which by Wurtz reaction is converted to gaseous hydrocarbon containing less than four carbon atoms. (A) is:

A



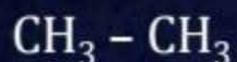
B



C



D

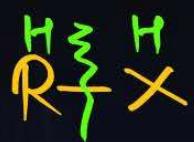


B. Reaction with Zn/H⁺: (RedⁿRxn)

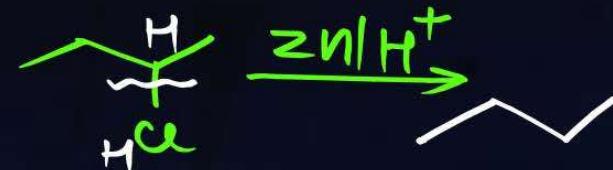


P
W

$\text{R}-\text{F}$ \times
 C_2F_5 BE high



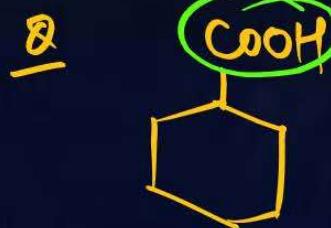
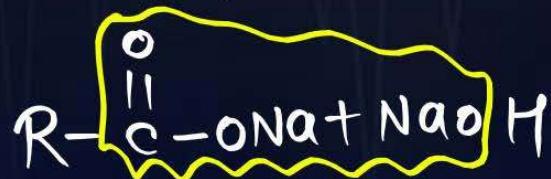
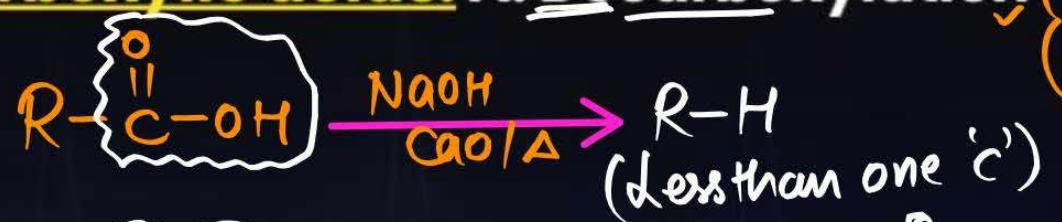
Q



[BE ↓ ROR ↑]

3. From Carboxylic acids: A. Decarboxylation

P
W

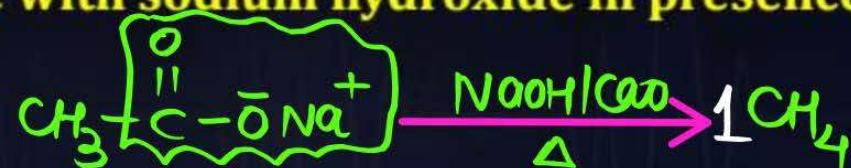


C.Q. 4 [NEET 2023]



Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is:

A 18



B 16

C 32

D 30

$$1 \text{ mol} \longrightarrow 16$$

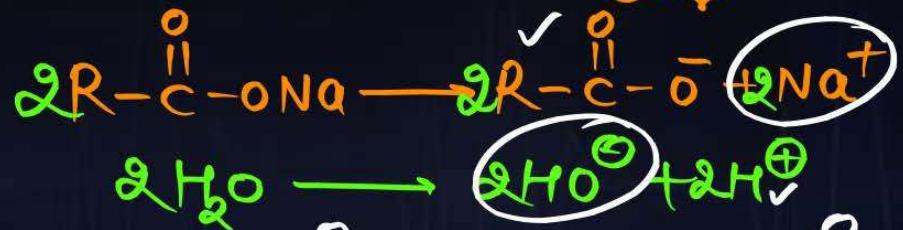
$$2 \text{ mol} \longrightarrow \underline{\underline{32 \text{ gm}}}$$

B. Kolbe's electrolytic method: (sodium or potassium salt)

P
W



Mech

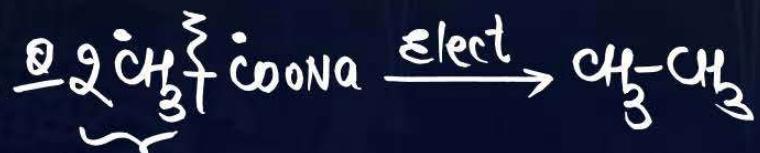


At Cathode:



Op point

- ① CO_2 at anode
- ② H_2 at cathode
- ③ alkane at anode
- ④ Nature of sol $\frac{v}{-}$ Basic



C.Q. 5

PW

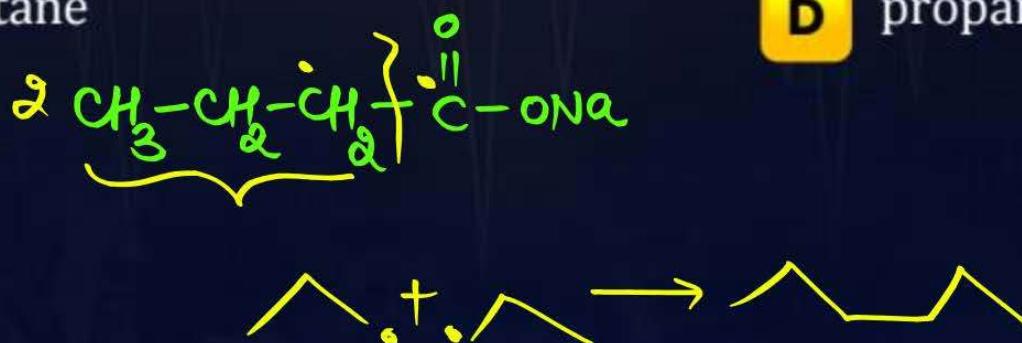
Kolbe's synthesis of sodium salt of butanoic acid gives:

A n-hexane

C n-butane

B iso-butane

D propane



Physical Properties of Alkanes:

1. Boiling Point

B.P \propto force of attracⁿ \propto M.W \propto BP

① B.P \propto No. of 'c' atom

② B.P \propto $\frac{1}{\text{Branch}}$ (No. of 'c' are same)



2. Melting Point

M.P \propto C.L.E packing

3. Solubility

Like dissolve Like
polar in polar solvent
Nonpolar " nonpolar solvent

C.Q. 6 [NEET 2024]



Given below are two statements:

Statement-I: The boiling point of three isomeric pentanes follows the order



Statement-II: When branching increases, the molecule attains a shape of sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak, thereby lowering the boiling point.

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

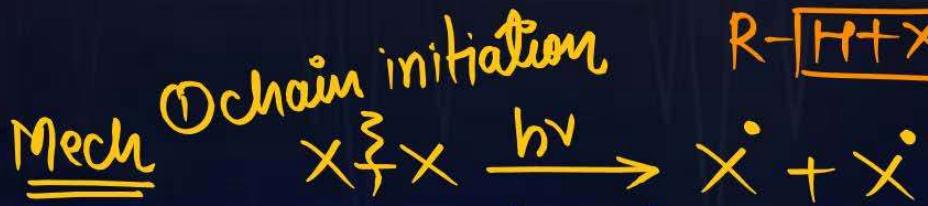
- A Statement I is correct but Statement II is incorrect.
- B Statement I is incorrect but Statement II is correct.
- C Both Statement I and Statement II are correct.
- D Both Statement I and Statement II are incorrect.



Chemical Properties of Alkanes



1. Halogenation:



② chain propagation



③ chain termination

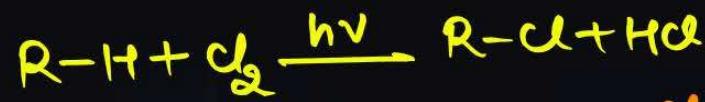


OP Points



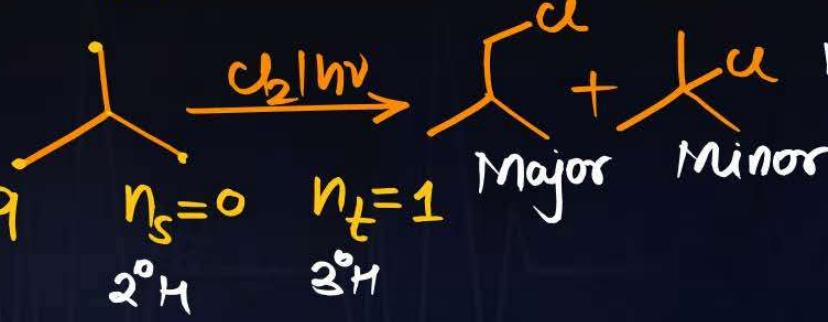
1. Radical formation ✓
2. Formation of alkyl radical is RDS ✓
3. No rearrangement ✓
4. R.O.R for C-H: $3^\circ > 2^\circ > 1^\circ$ ✓
5. R.O.R for X_2 : $F_2 > Cl_2 > Br_2 > I_2$
6. Maximum amount of $R-X$ is formed in chain propagation step.
7. Fluorination- It is highly exothermic & uncontrolled Reaction.
It gives Carbon black and HF.

8. Chlorination-



$\gamma_p : \gamma_s : \gamma_t = 1 : 3.8 : 5$
rate at 'c'

$$\frac{n_p}{n_o o f \text{ } 1^{\circ}H} = 9$$



$$\checkmark n_p \gamma_p = 9 \times 1$$

$$n_t \gamma_t = 1 \times 5$$

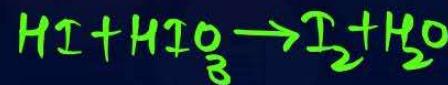
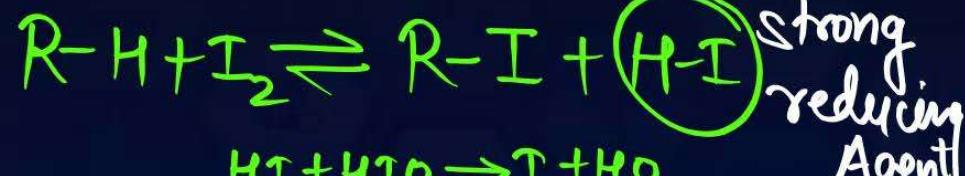
9. Bromination

$$\gamma_p : \gamma_s : \gamma_t = 1 : 82 : 1600$$

[always 3° Major]



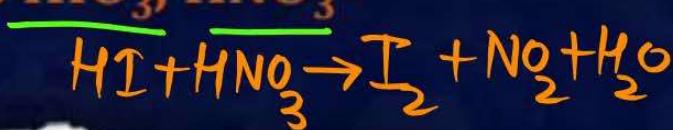
BE ↓



10. Iodination

Bond energy: $H-F > HCl > HBr > HI$

It takes place only when Oxidizing agent like HIO_3, HNO_3



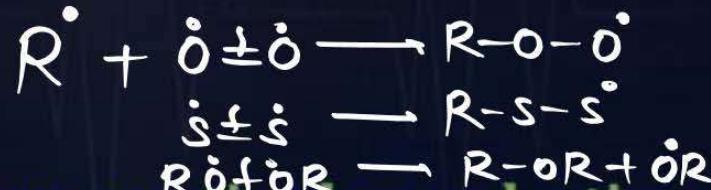
11. Radical reaction involves

A. Initiation ✓

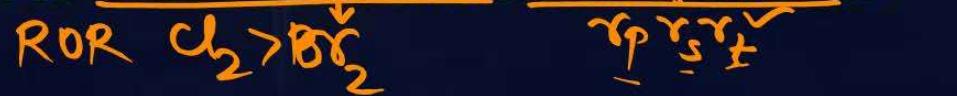
B. Propagation ✓

C. Termination ✓

12. Radical reaction can be slow down by adding O_2 , S_2 or any other peroxide.



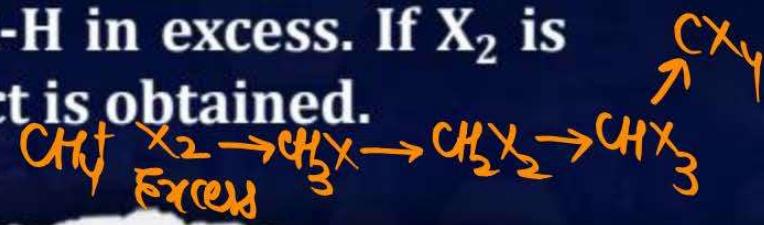
13. Chlorination is more reactive less selective.



Bromination is more selective less reactive.



14. For good yield of $R-X$ we have to take $R-H$ in excess. If X_2 is used in excess then fully halogenated product is obtained.

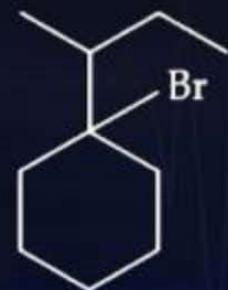


C.Q. 7 (JEE Mains 2025, 22 January Shift-2)

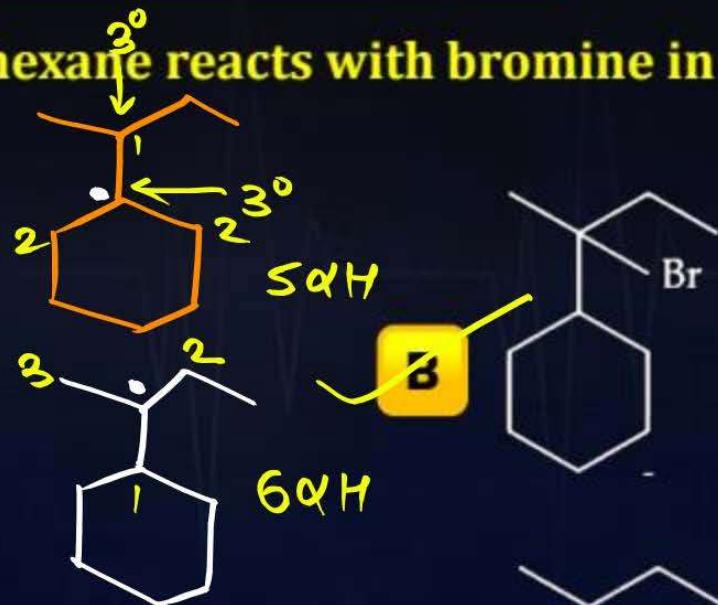


When sec-butylcyclohexane reacts with bromine in the presence of sunlight, the major product is:

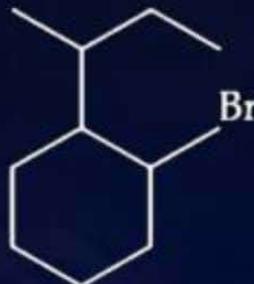
A



C



D



C.Q. 8 (NCERT Exemplar)

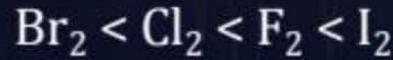


Arrange the halogens F_2 , Cl_2 , Br_2 , I_2 in order of their increasing reactivity with alkanes.

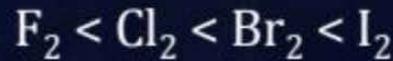
A



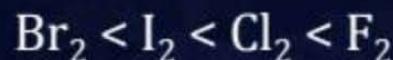
B



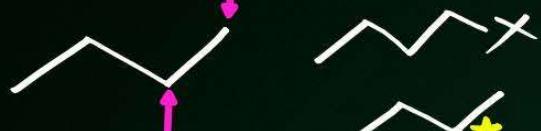
C



D

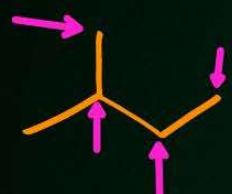


No of products



E.S ✓

2

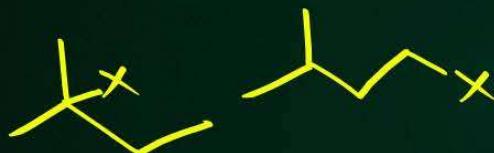


I.S ✓

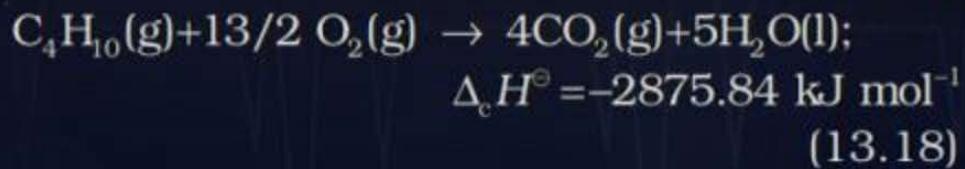
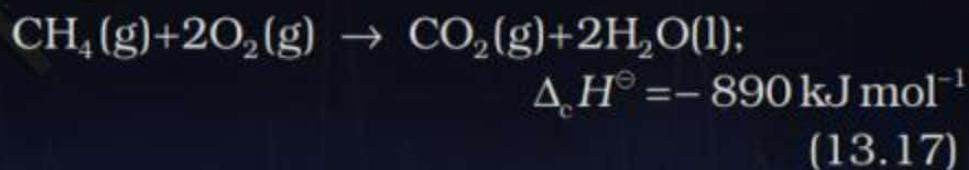
3

4

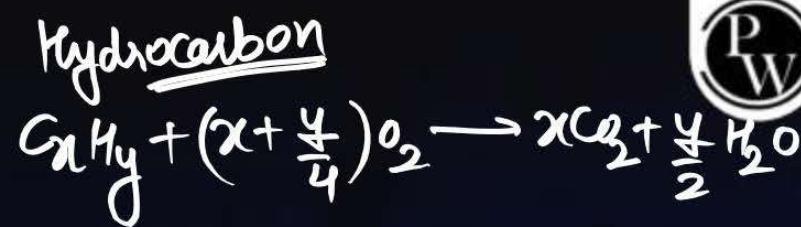
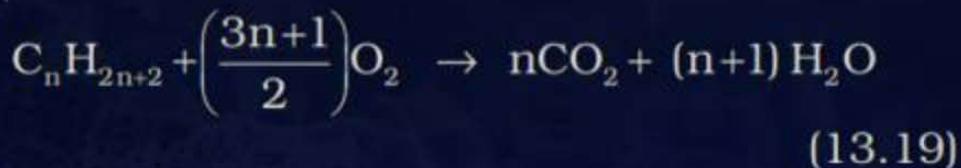
6



2. Combustion: (complete combustion)



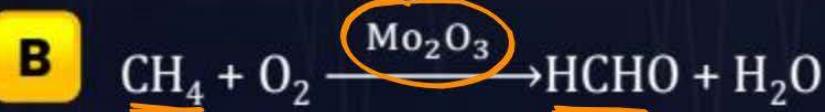
The general combustion equation for any alkane is :



C.Q. 9 (NCERT Exemplar)



Which of the following reactions of methane is incomplete combustion:



C.Q. 10



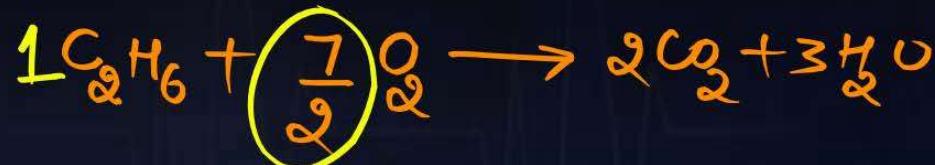
How much volume of oxygen will be needed for complete combustion of 10 lit. of ethane?

A 135 lit.

B 35 lit.

C 175 lit.

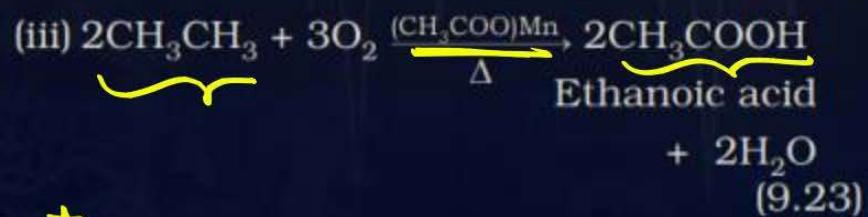
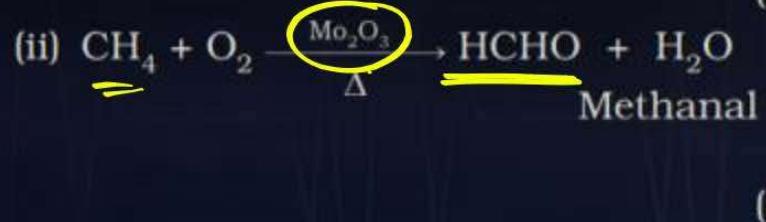
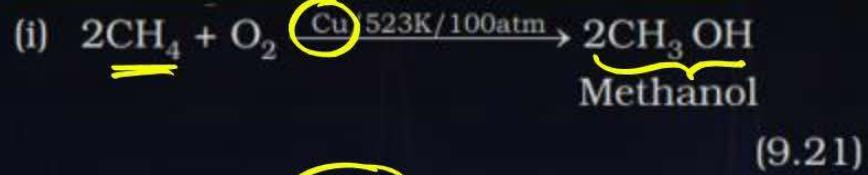
D 205 lit.



$$V_{\text{O}_2} = 10 \times \frac{7}{2}$$

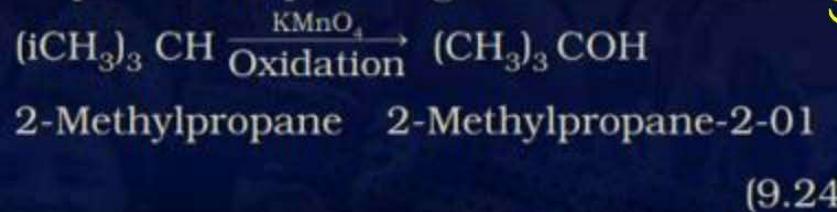
$$= 35 \text{ L}$$

3. Controlled Oxidation:



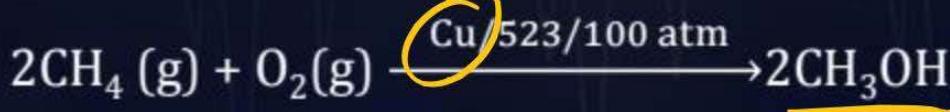
★ (iv) Ordinarily alkanes resist oxidation but alkanes having tertiary H atom can be oxidized to corresponding alcohols by potassium permanganate.

3° alkane \rightarrow Al(oh)o



C.Q. 11 (NCERT Exemplar)

Some oxidation reactions of methane are given below. Which of them is controlled oxidation reactions?

A**B****C****D**

Both (B) & (C)

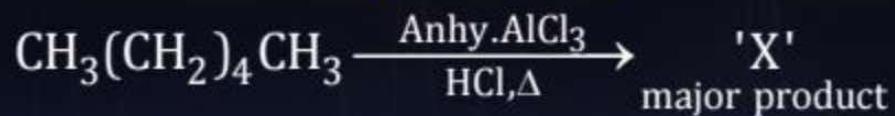
4. Isomerization:



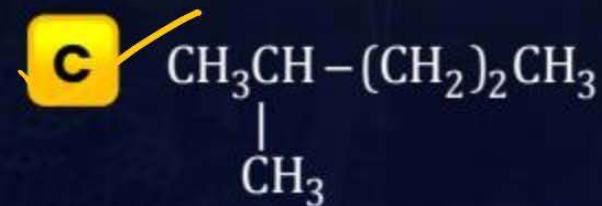
C.Q. 12 (13 April, JEE Mains 2023 Shift-I)



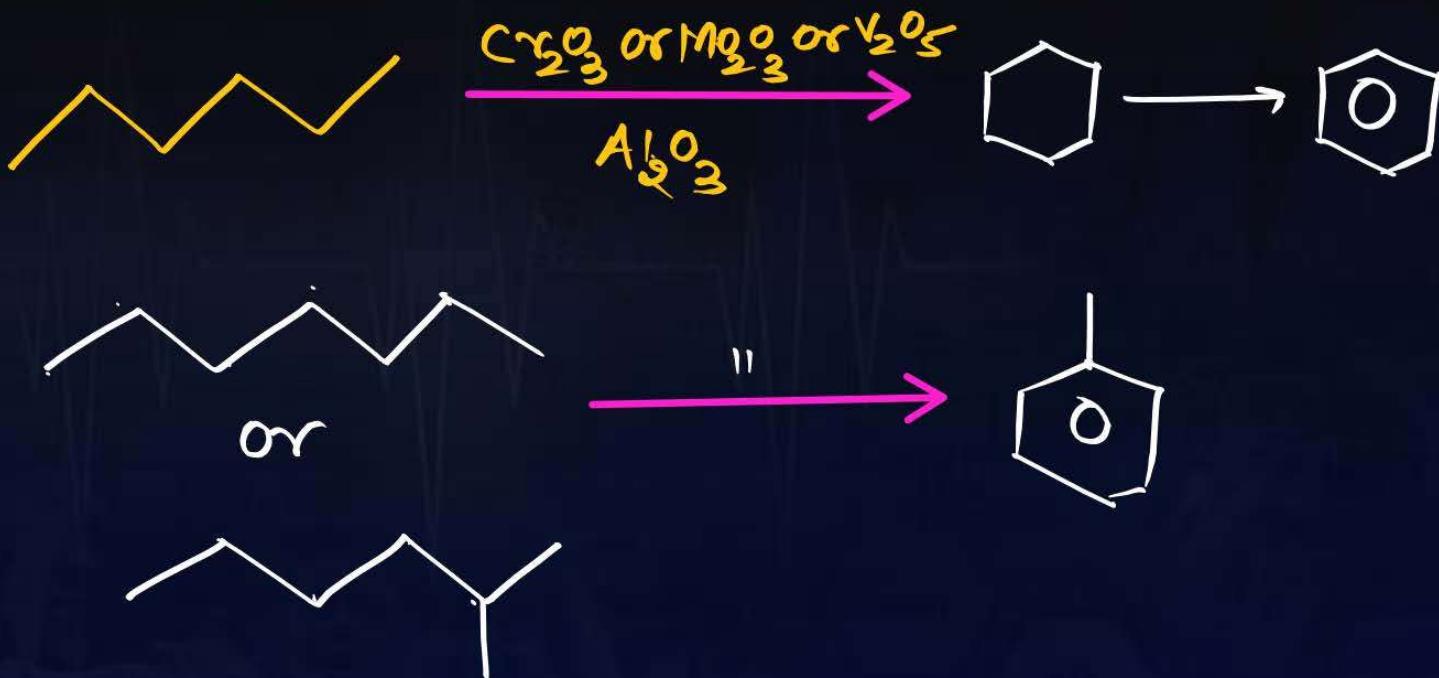
In the following reaction, 'X' is:



- A $\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{Cl}$ B $\text{ClCH}_2(\text{CH}_2)_4\text{CH}_2\text{Cl}$



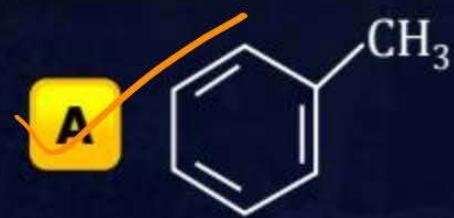
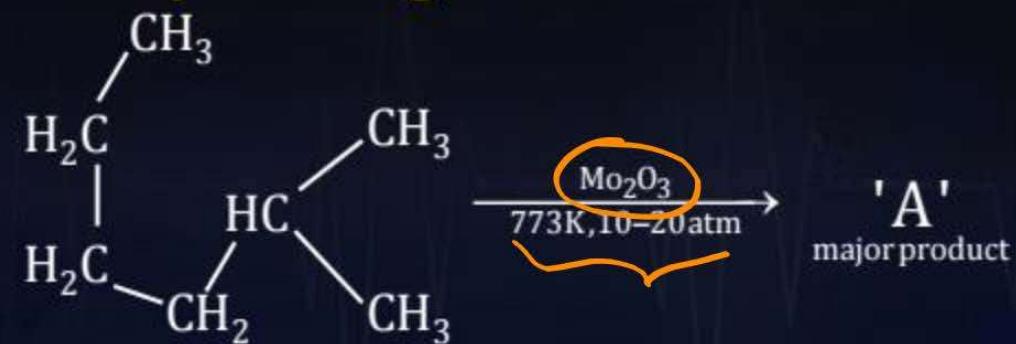
5. Aromatization:



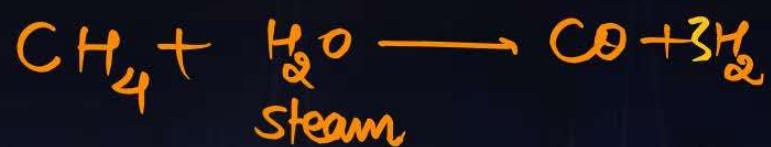
C.Q. 13 (25 Feb. JEE Mains 2021)



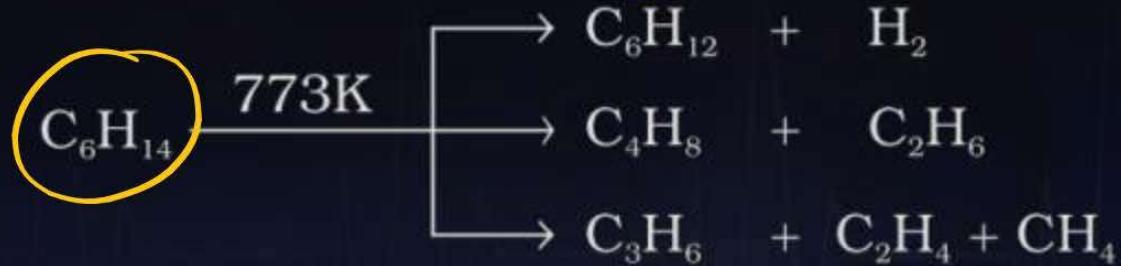
Identify A in the given chemical reaction.



6. Reaction with steam:



7. Pyrolysis: Heating in absence of air.





Methods of Preparation of Alkenes

1. From alkynes:

a) cis alkene

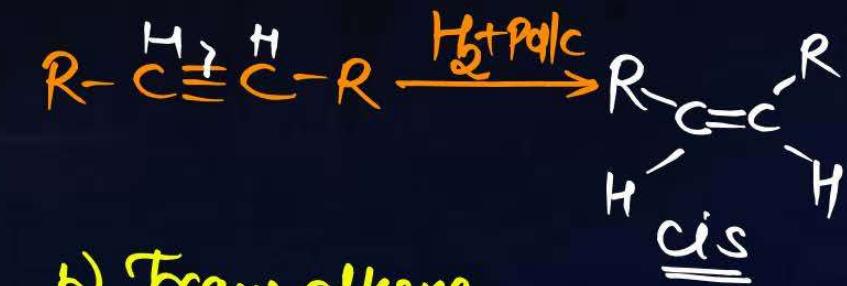


Pd/C

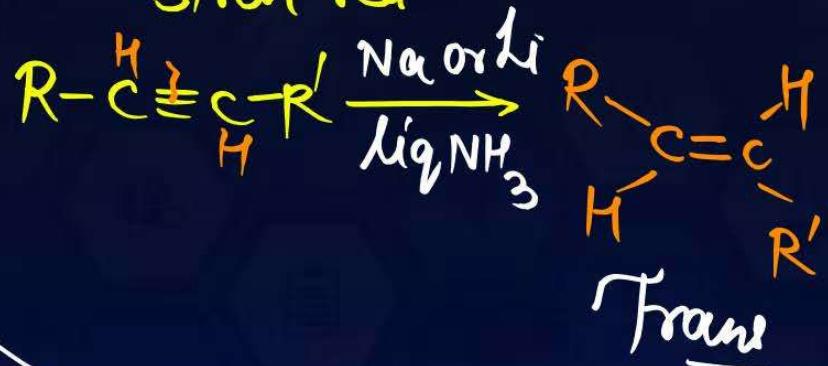
or

Pd/CaCO₃

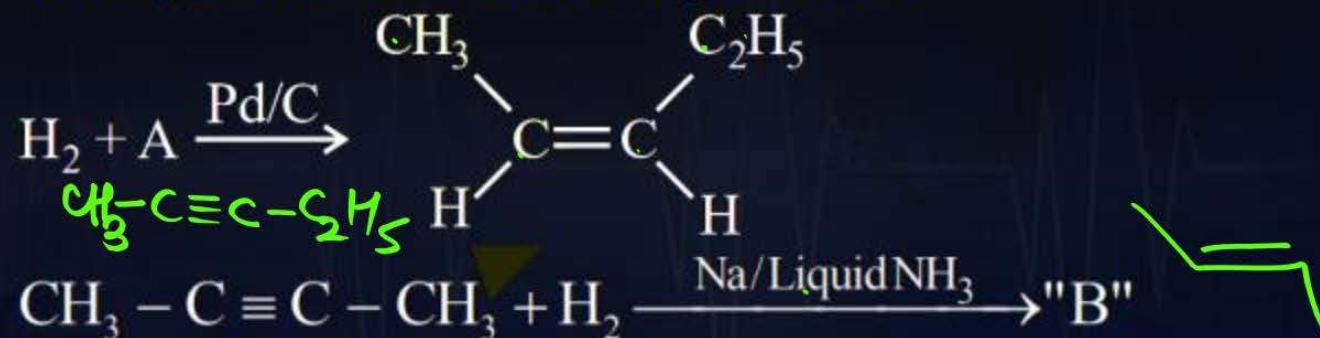
S-quinoline



b) Trans alkene
Birch redⁿ



In the given reactions identify A and B.



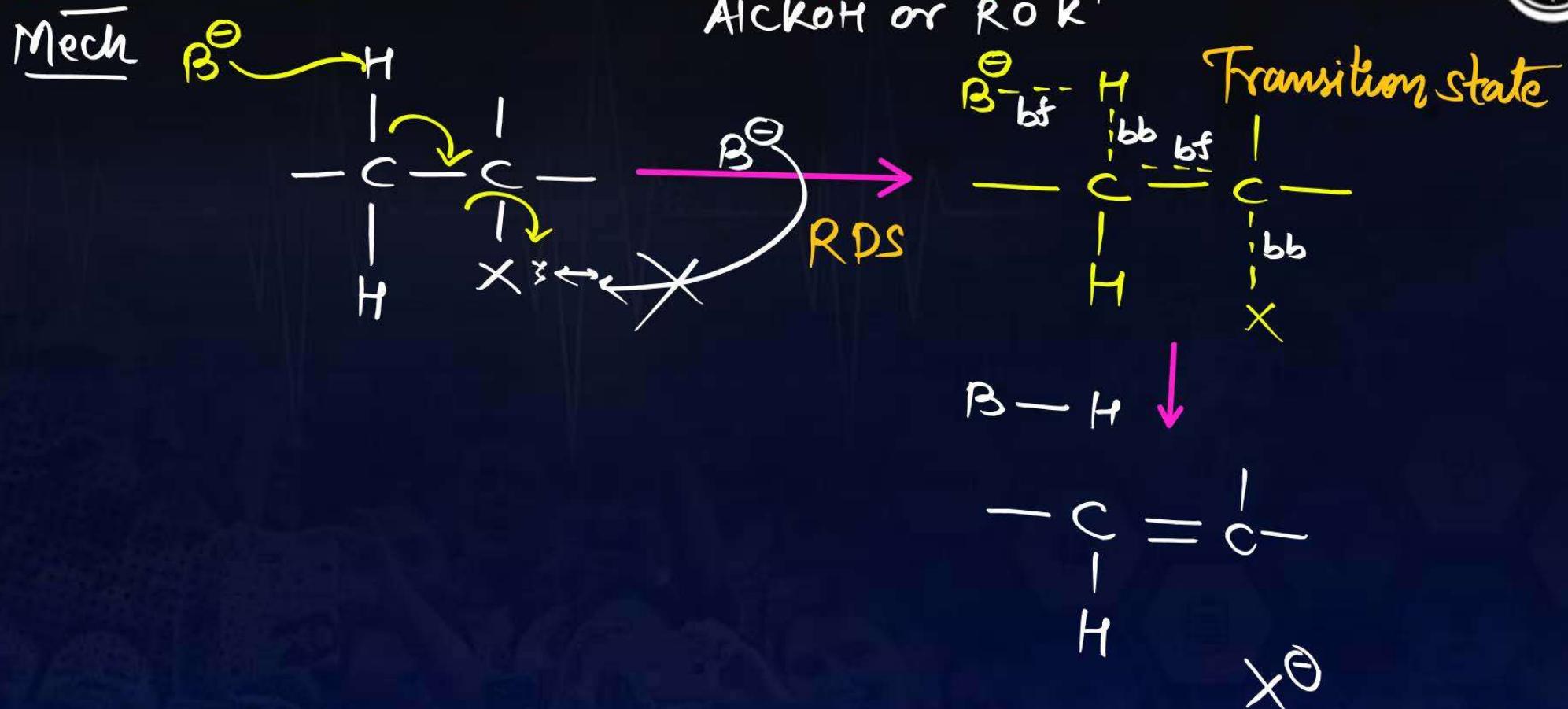
- | | |
|---|--|
| A
<input checked="" type="checkbox"/> A: 2-Pentyne
<input type="checkbox"/> B: n-Pentane
<input type="checkbox"/> C: 2-Pentyne
<input type="checkbox"/> D: n-Pentane | B: trans-2-butene

B: trans-2-butene

B: cis 2 -butene

B: cis-2-butene |
|---|--|

2. From alkyl halides: E² or Dehydrohalogenation



OP Points:

1. No intermediate formation. Only Transition state is formed.
2. All 5 atoms involve in T.S are in same plane.

3. R.O.R w.r.t. RX

R - F < R - Cl < R - Br < R - I

$\text{BE} \downarrow \text{ROR} \uparrow$

R.O.R w.r.t. RX

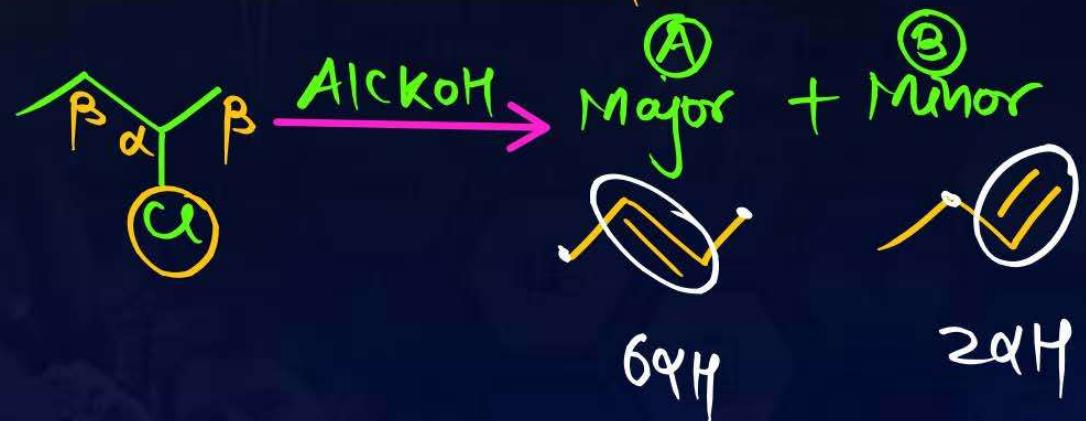
ROR \propto Stability of alkene \propto Reso \propto Hyper

4. More stable alkene is major product.

$(R > H)$

5. Anti Elimination

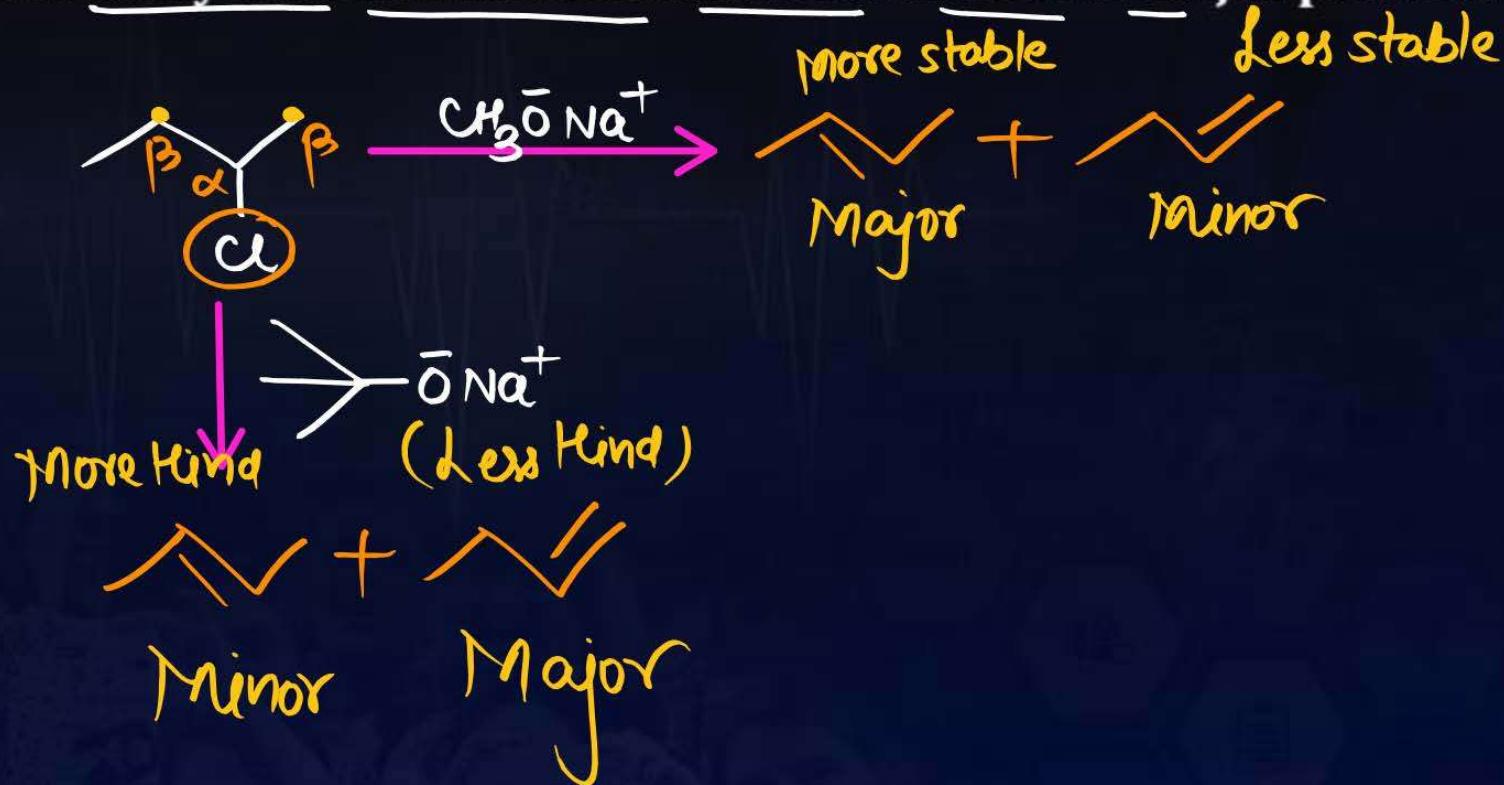
6. $\text{ROR}_r = k[\underline{\text{R-X}}]^1[\underline{\text{B}^-}]^1$



OP Points:

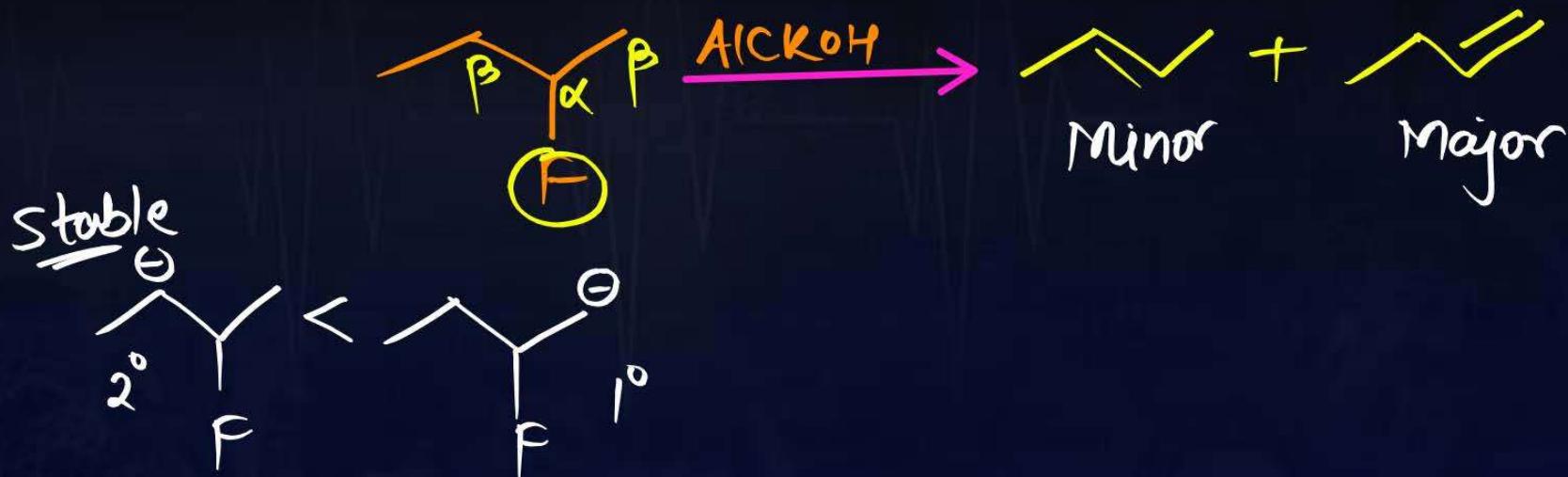
→ 3° Alkoxide

7. In case of bulky base less hindered beta H will decide major product.



OP Points:

8. In case of R-F

more stable βC^- major

OP Points:

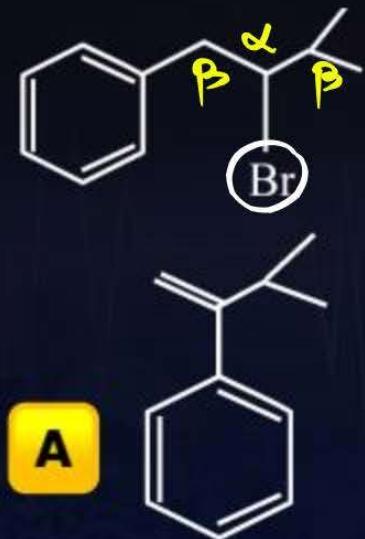
9. Saytzeff and Hoffmann alkenes

↓
More substituted
more α -C

↓
less subs
Less α -C

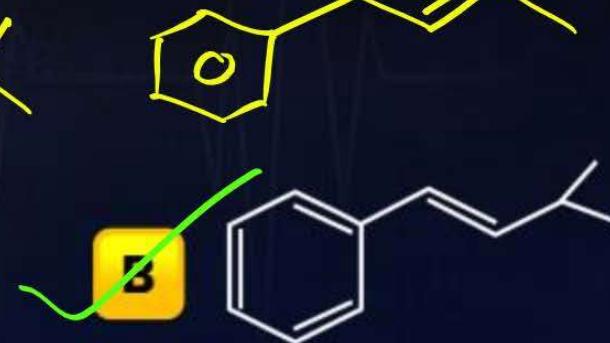
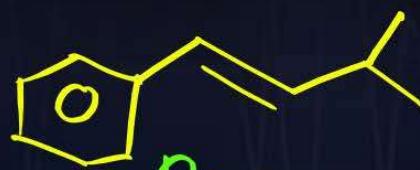


C.Q. 15 (JEE Mains 4th April 2024, Evening Shift)

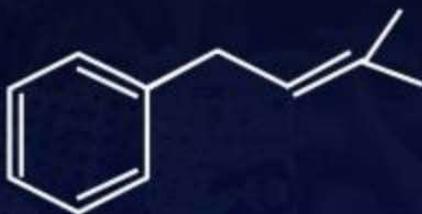


$KOH(alc)$
 Δ

major product "P". Product P is:

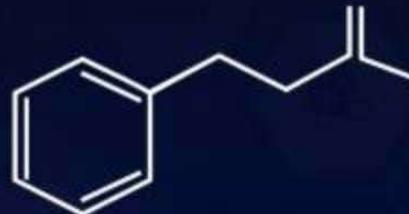


A



C

B



D

C.Q. 16 (JEE Mains 5th April 2024, Evening Shift)

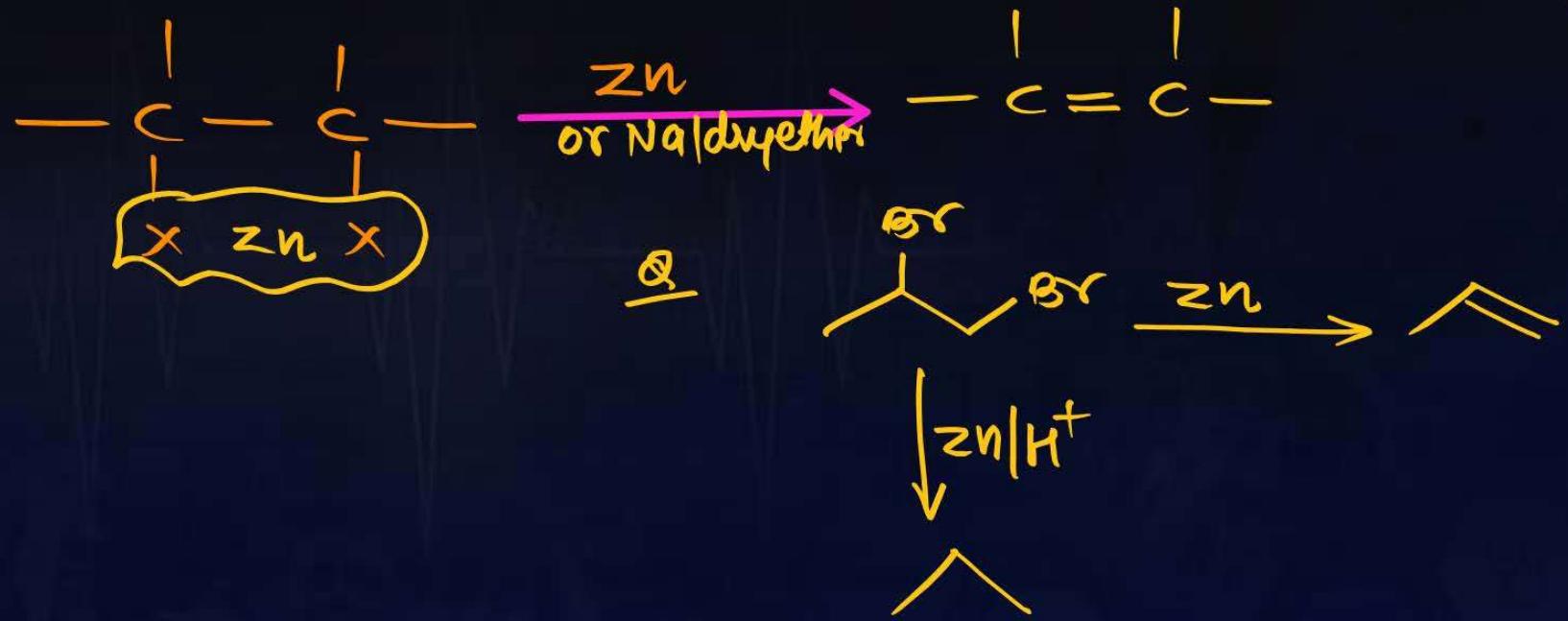


Identify the major product in the following reaction.



- A
- B
- C
- D

3. From vicinal dihalides:



The increasing order of reduction of alkyl halides with zinc and dilute HCl is:

A $\text{R}-\text{Cl} < \text{R}-\text{I} < \text{R}-\text{Br}$

B $\text{R}-\text{Cl} < \text{R}-\text{Br} < \text{R}-\text{I}$



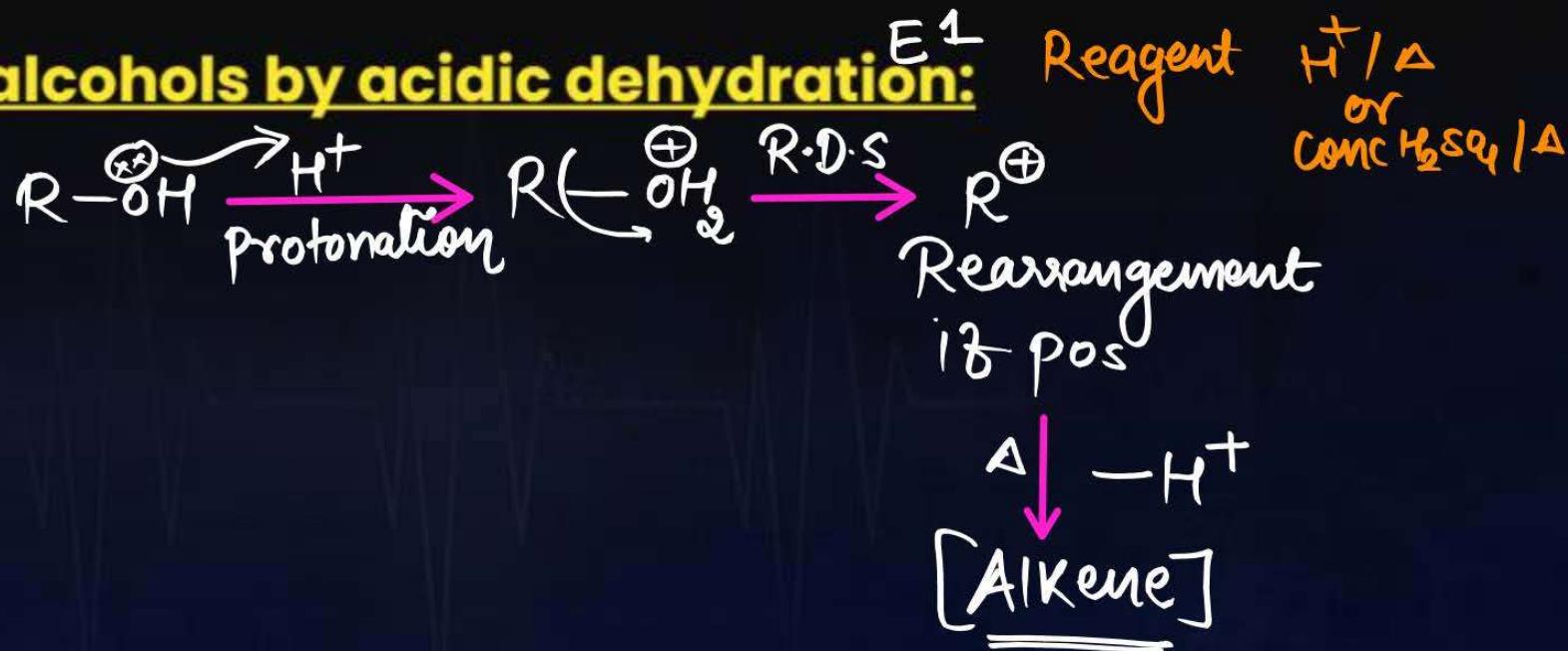
C $\text{R}-\text{I} < \text{R}-\text{Br} < \text{R}-\text{Cl}$

D $\text{R}-\text{Br} < \text{R}-\text{I} < \text{R}-\text{Cl}$



4. From alcohols by acidic dehydration:

Mech

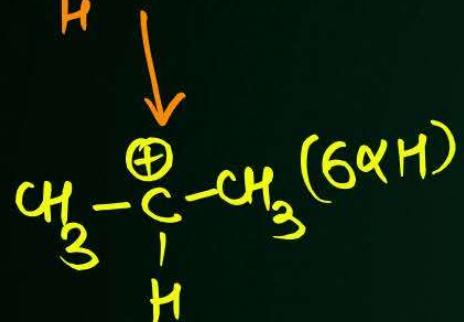
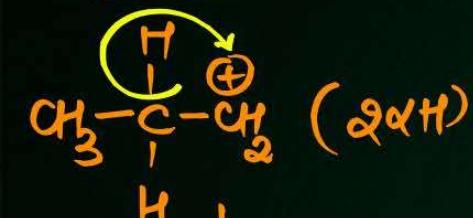


OP Points:

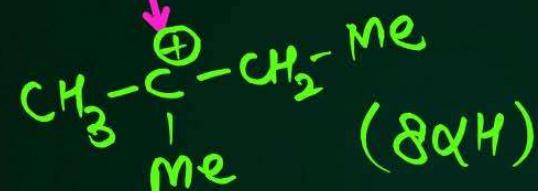
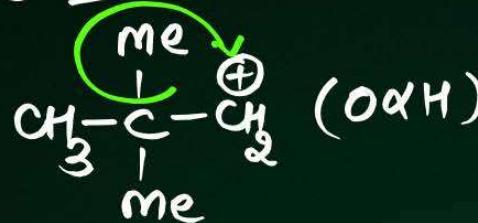
1. Formation of Carbocation ✓
2. Rearrange If possible ✓
3. R.O.R or Reactivity \propto Stability of 1st carbocation
4. ROR r = k[R-⁺OH₂]¹
5. E1 mechanism
6. More stable alkene is the major product.

Rearr.

① H[⊖] shift



② Me[⊖] shift

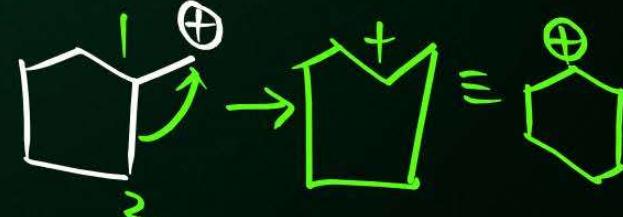
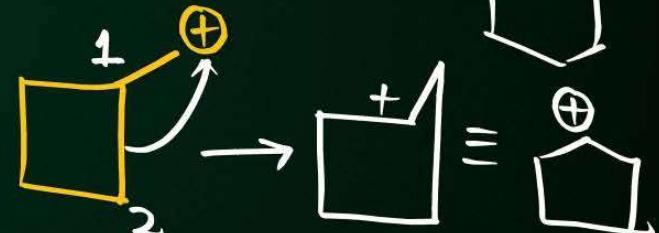


Priority Ring exp > H[⊖] > Me[⊖]

③ Ring exp

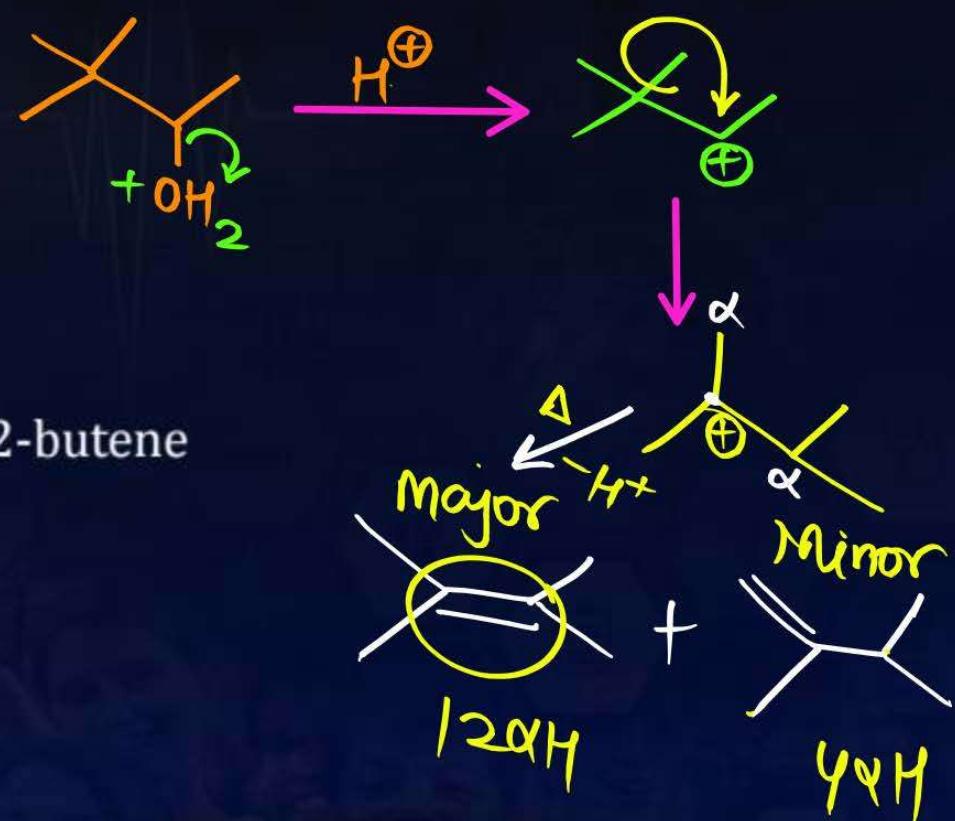
4, 5 ✓

3, 6 ✗



When 3, 3-dimethyl-2-butanol is heated with H_2SO_4 , the major product obtained is:

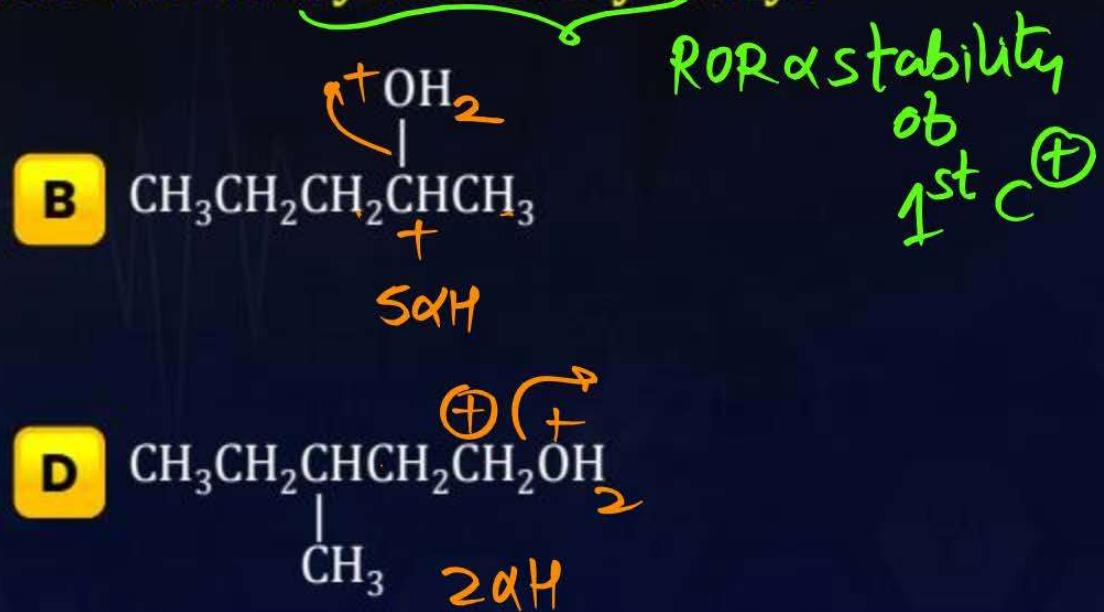
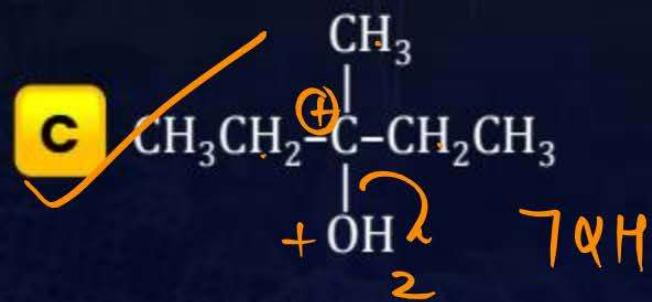
- A 2, 3-dimethyl-2-butene
- B 3, 3-dimethyl-1-butene
- C 2, 3-dimethyl-1-butene
- D cis & trans isomers of 2, 3-dimethyl-2-butene

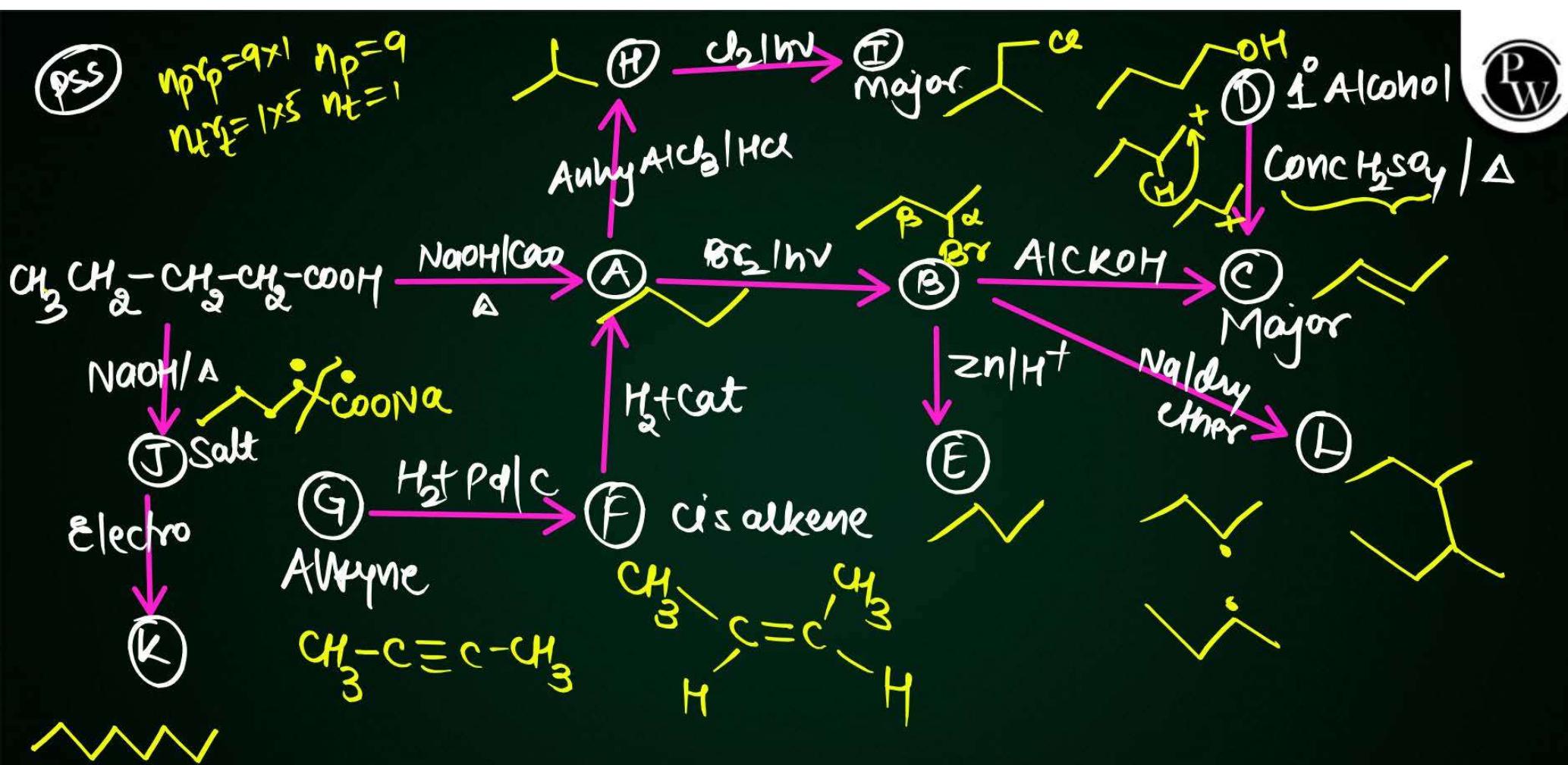


C.Q. 19



Among the following compounds which can be dehydrated very easily?



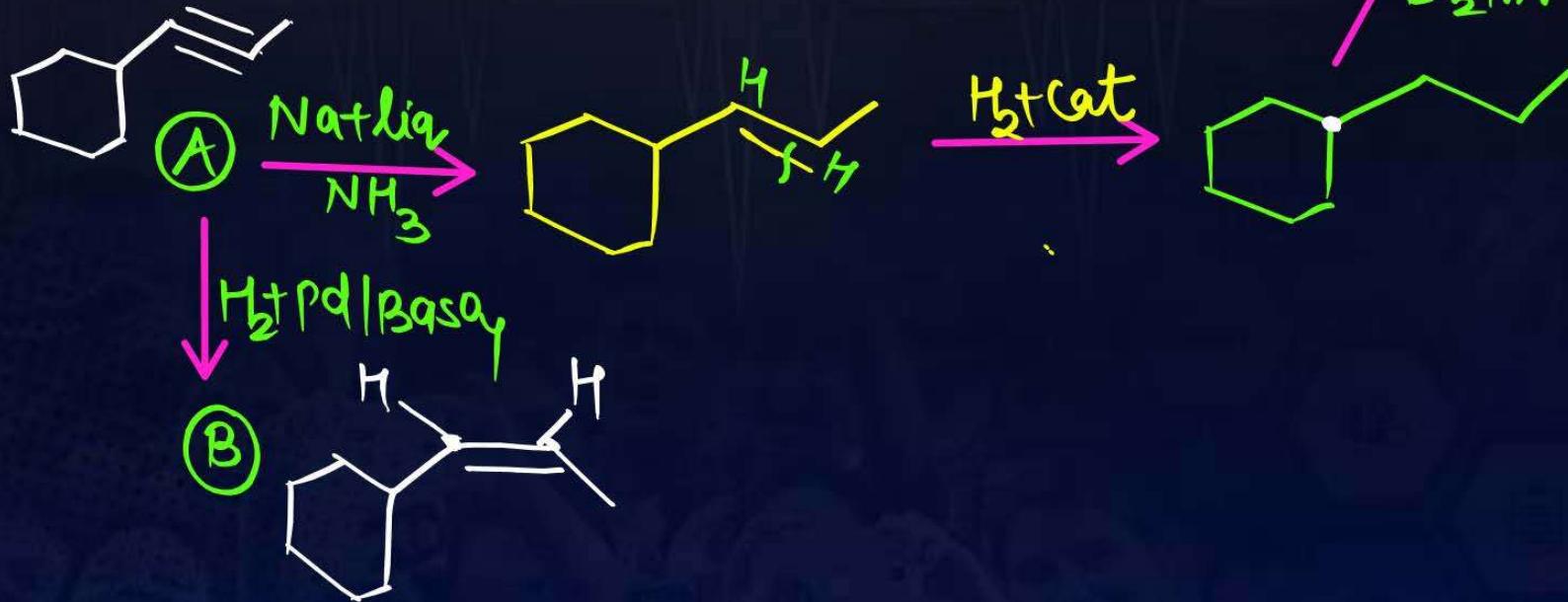




Chemical Properties of Alkenes

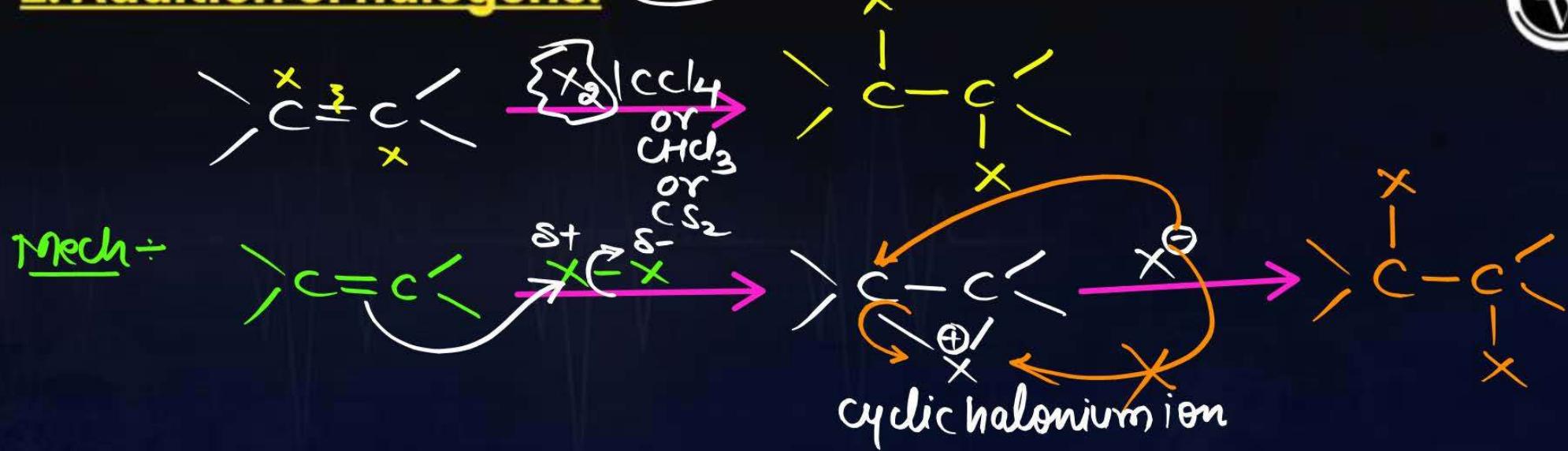


1. Addition of dihydrogen:



2. Addition of halogens:

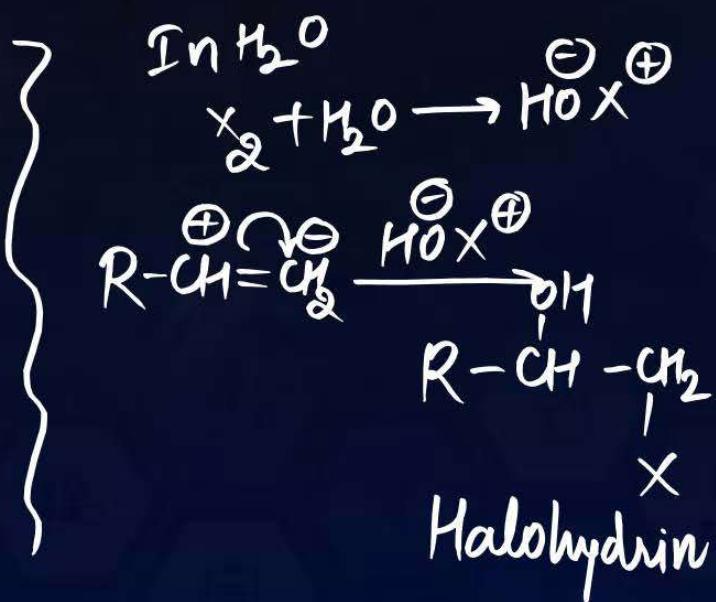
EAR



PW

OP Points

1. Non-Classical Carbocation formation is the RDS.
2. ROR α Nucleophilicity of Alkene α Stability of partial positive C.
3. No Rearrangement occurs
4. Cyclic Halonium ion formation.
5. CCl_4 or CH_2Cl_2 can be used as inert solvent.
6. Anti Addition



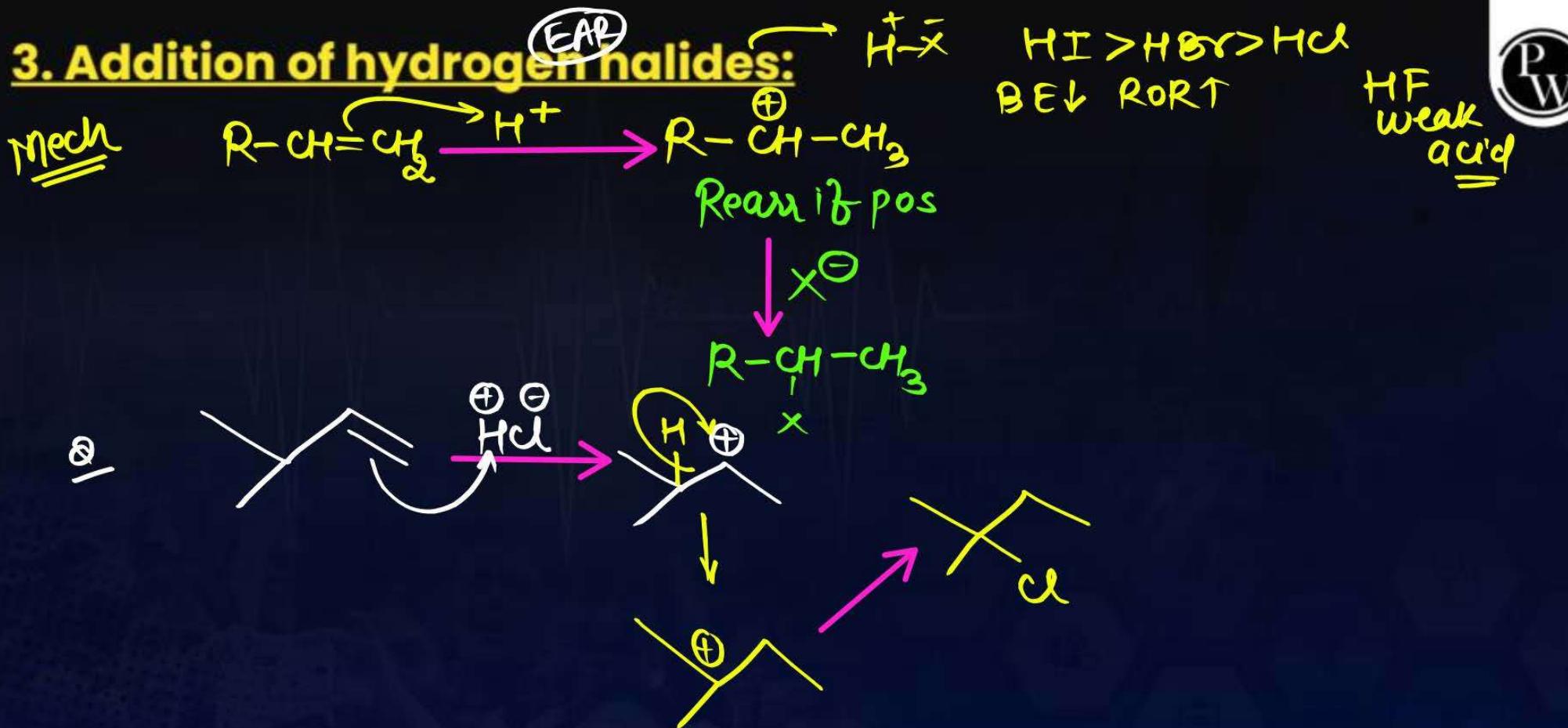
C.Q. 20



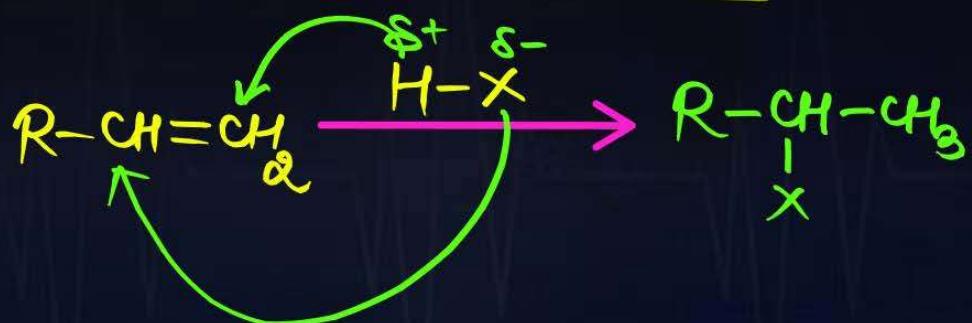
Assertion(A): Propene is more reactive than ethene towards electrophilic addition reactions.

Reason(R): Electron density of double bond increases due to hyperconjugation of methyl group.

- A** If both (A) and (R) are correct and (R) is the correct explanation for (A).
- B** If both (A) and (R) are correct but (R) is not the correct explanation for (A).
- C** If (A) is correct but (R) is incorrect.
- D** If (A) is incorrect but (R) is correct.

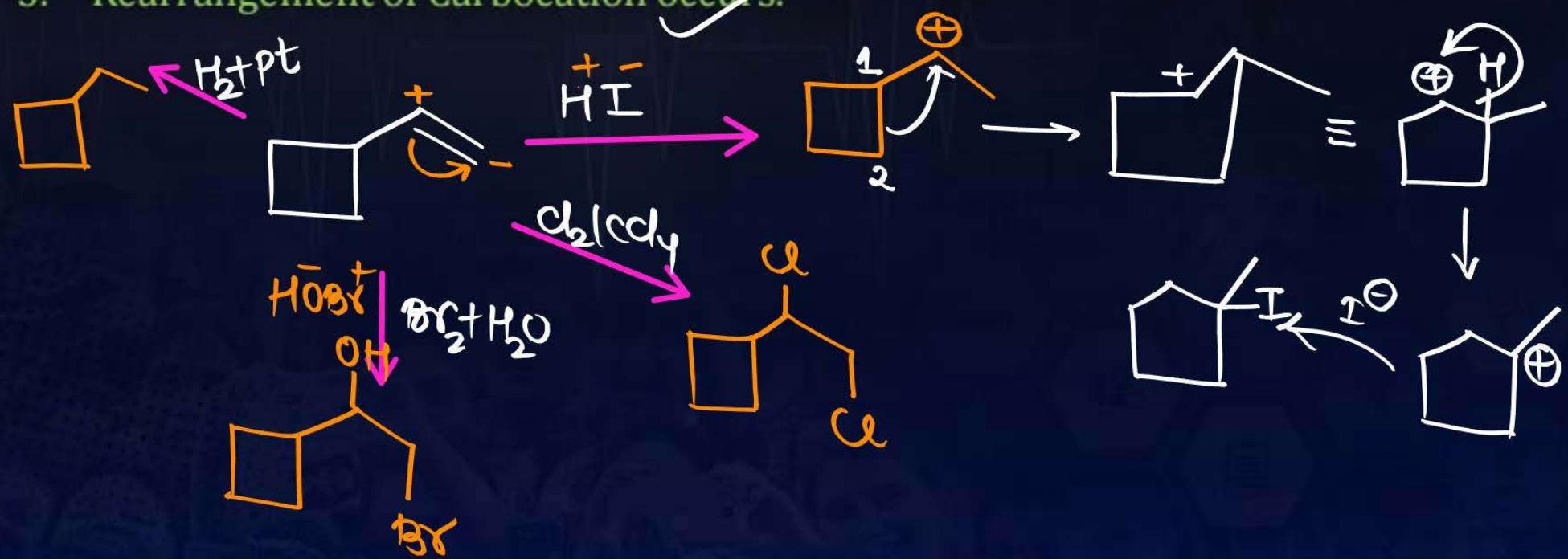


Markovnikov's Rule: The negative part of reagent is added to that carbon of alkene which has less no. of H atom.



OP Points

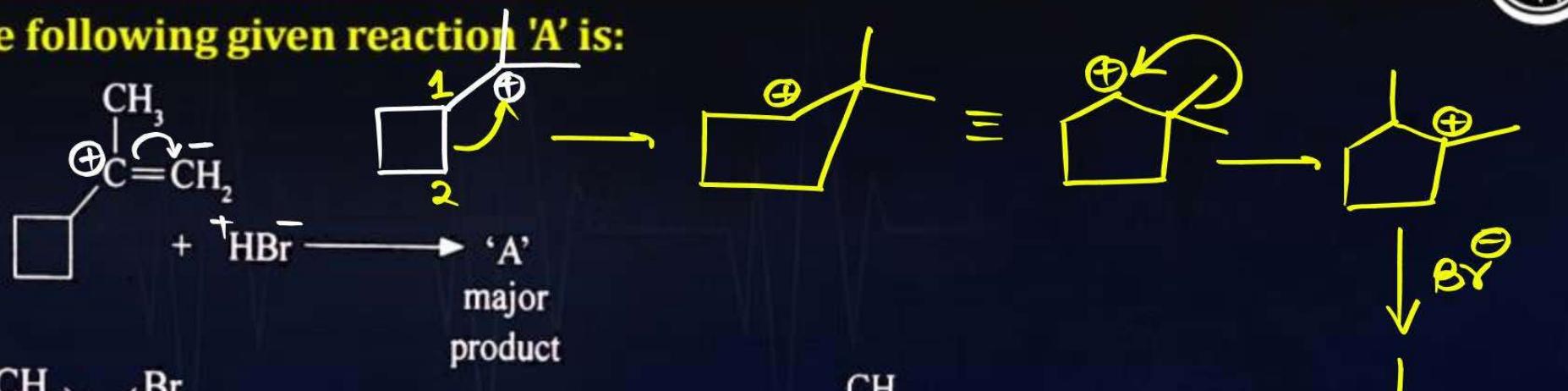
1. 1st Carbocation formation is the RDS.
2. ROR α Nucleophilicity of Alkene α Stability of 1st Carbocation
3. Rearrangement of Carbocation occurs.



C.Q. 21 (24 Jan, JEE Mains 2023)

P
W

In the following given reaction 'A' is:

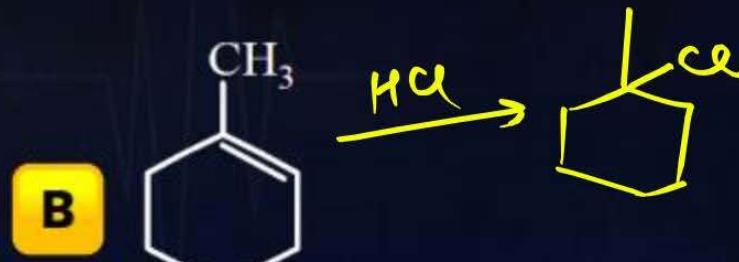
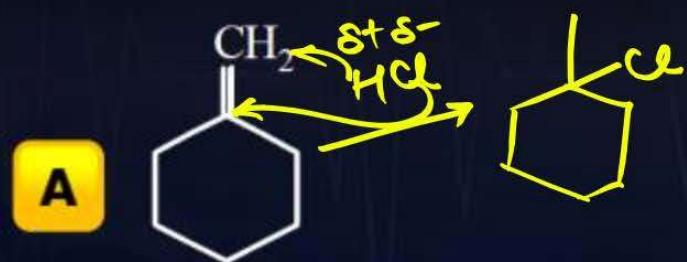


- A C(C1CCCCC1)Br
- B BrC1CCCCC1
- C CC1(CBr)CCCC1
- D CC(CBr)(C)C1CCCC1

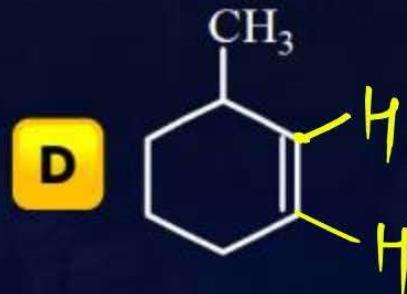
C.Q. 22 [NEET 2015 RS]

PW

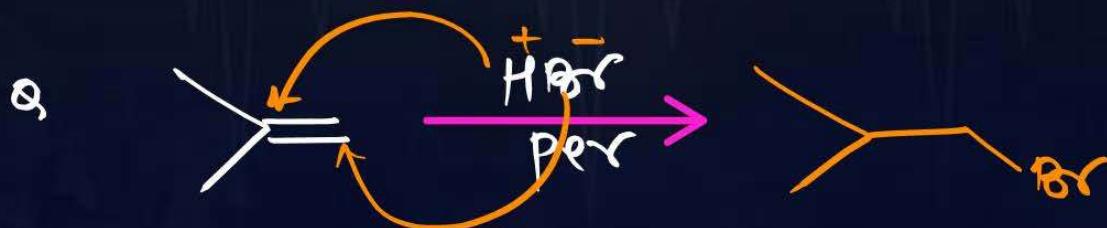
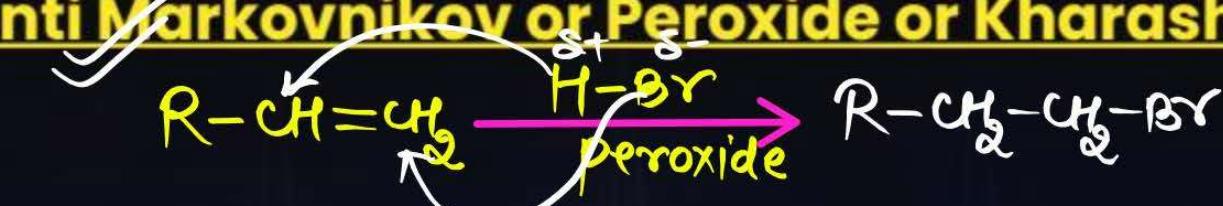
In the reaction with HCl, an alkene reacts in accordance with the Markovnikov's rule, to give a product 1-chloro-1-methylcyclohexane. The possible alkene is:



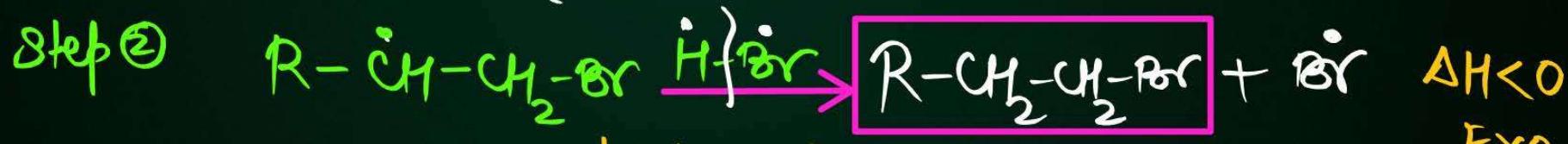
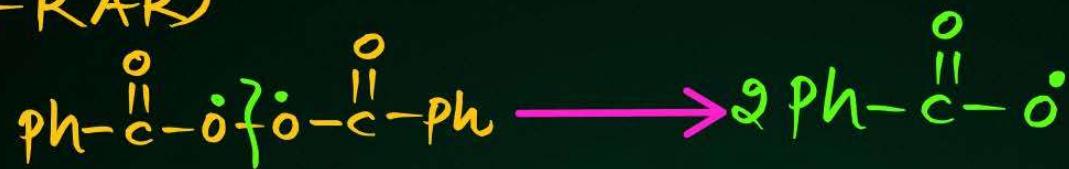
C  Both(A) and (B)



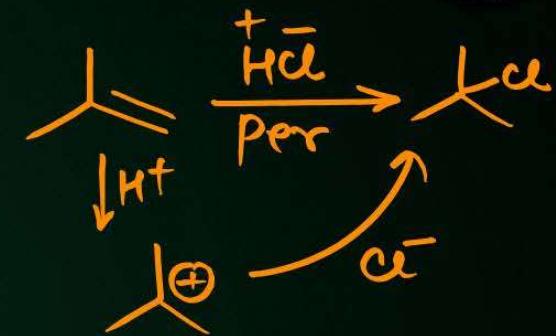
4. Anti Markovnikov or Peroxide or Kharash effect:

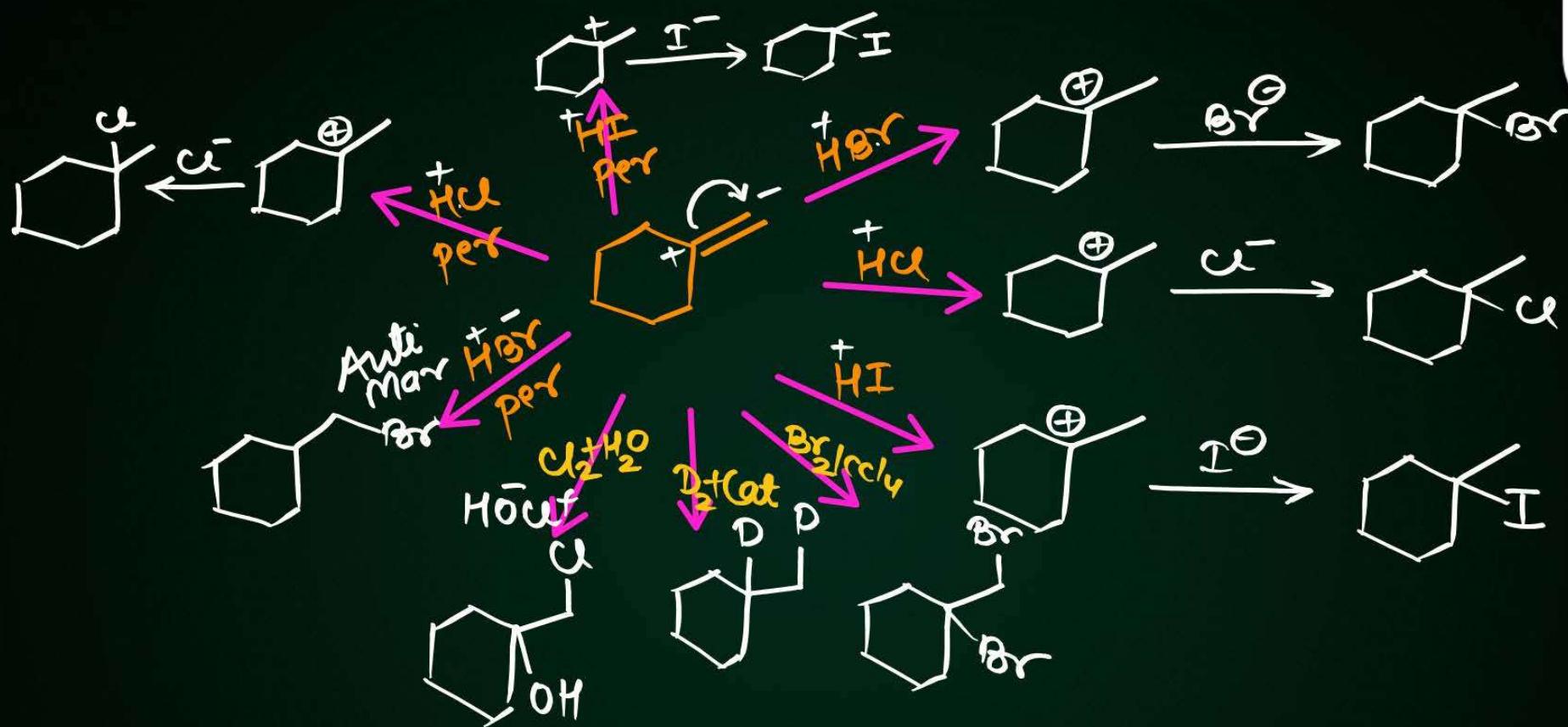


Mech ÷ (F R A R)



In HCl, HI one of the step is endothermic
 High BE Low BE

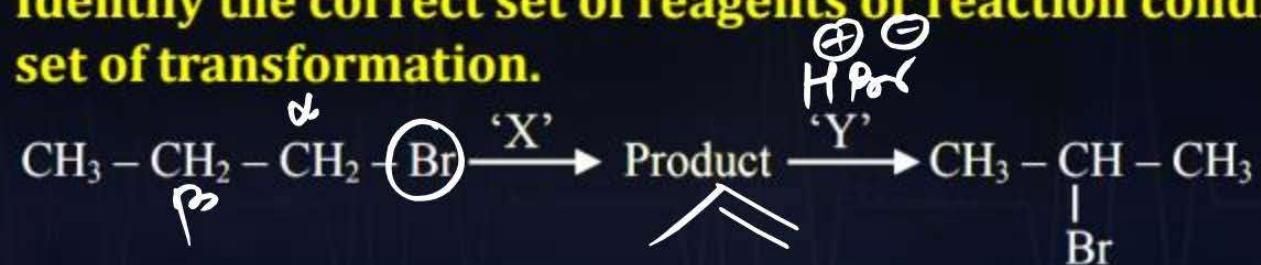




C.Q. 23



Identify the correct set of reagents or reaction conditions 'X' and 'Y' in the following set of transformation.

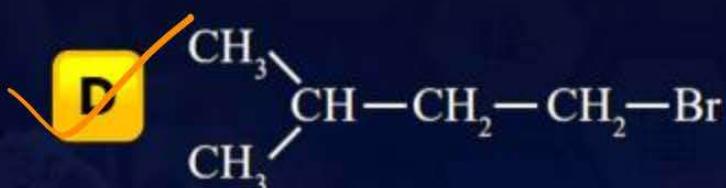
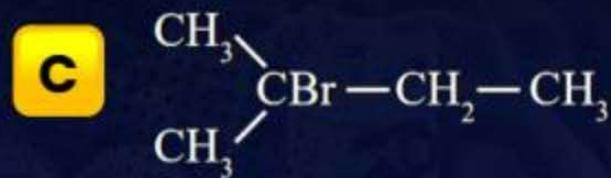
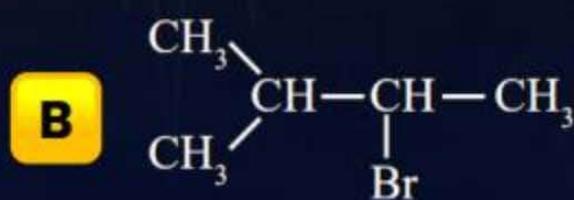
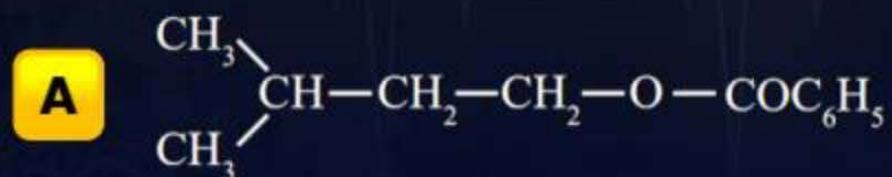
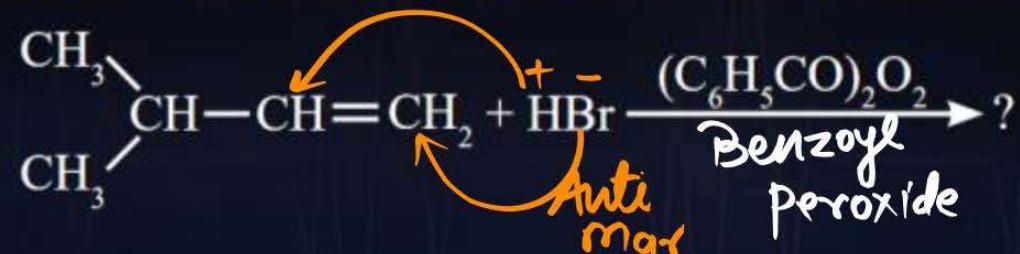


- A X = conc. alc. NaOH, 80°C, Y = Br₂/CHCl₃
- B X = dil. aq. NaOH, 20°C, Y = HBr/acetic acid
- C X = conc. alc. NaOH, 80°C, Y = HBr/acetic acid
- D X = dil. aq. NaOH, 20°C, Y = Br₂/CHCl₃

C.Q. 24 [NEET 2021]

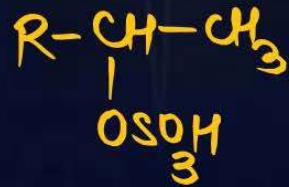
PW

The major product of the following chemical reaction is:

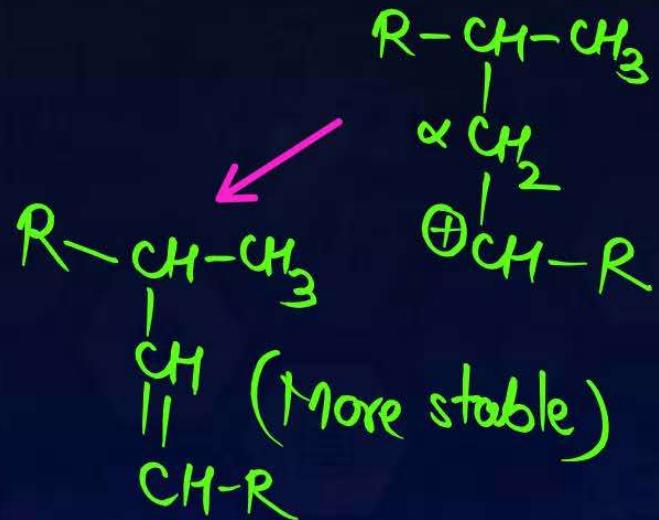
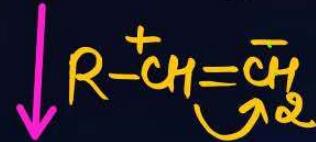


5. Addition of Sulphuric acid: (Same as $H^+ X^-$)

[Cold conc H_2SO_4]



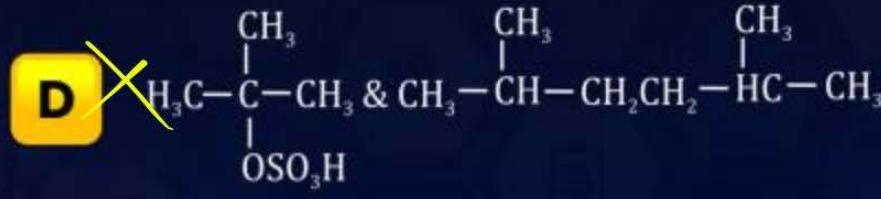
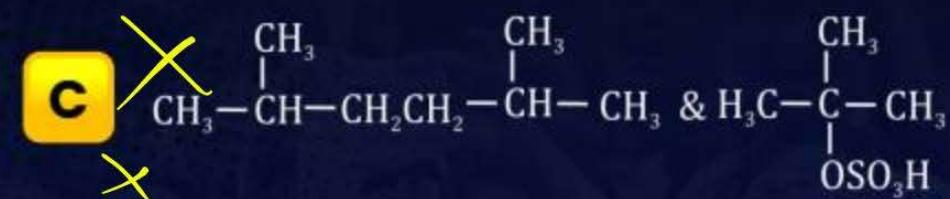
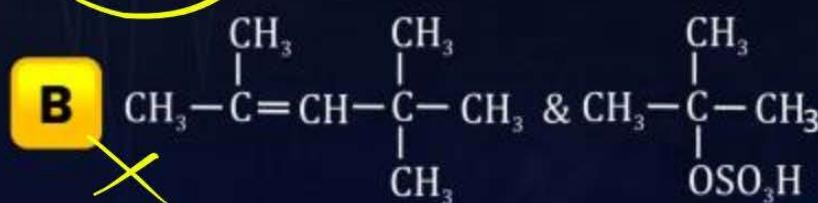
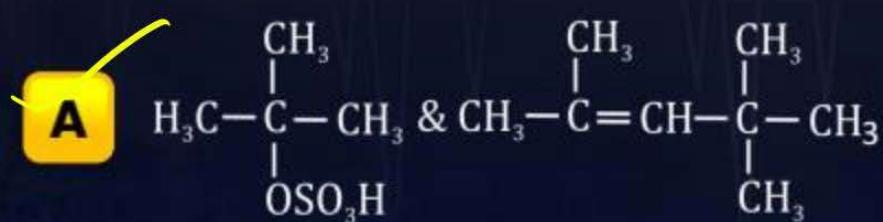
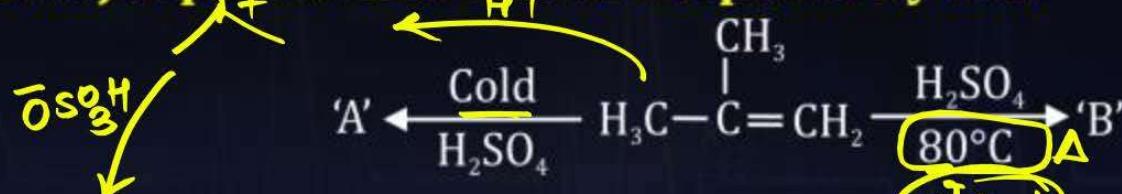
Hot conc H_2SO_4



C.Q. 25 (30 Jan, JEE Mains 2023)

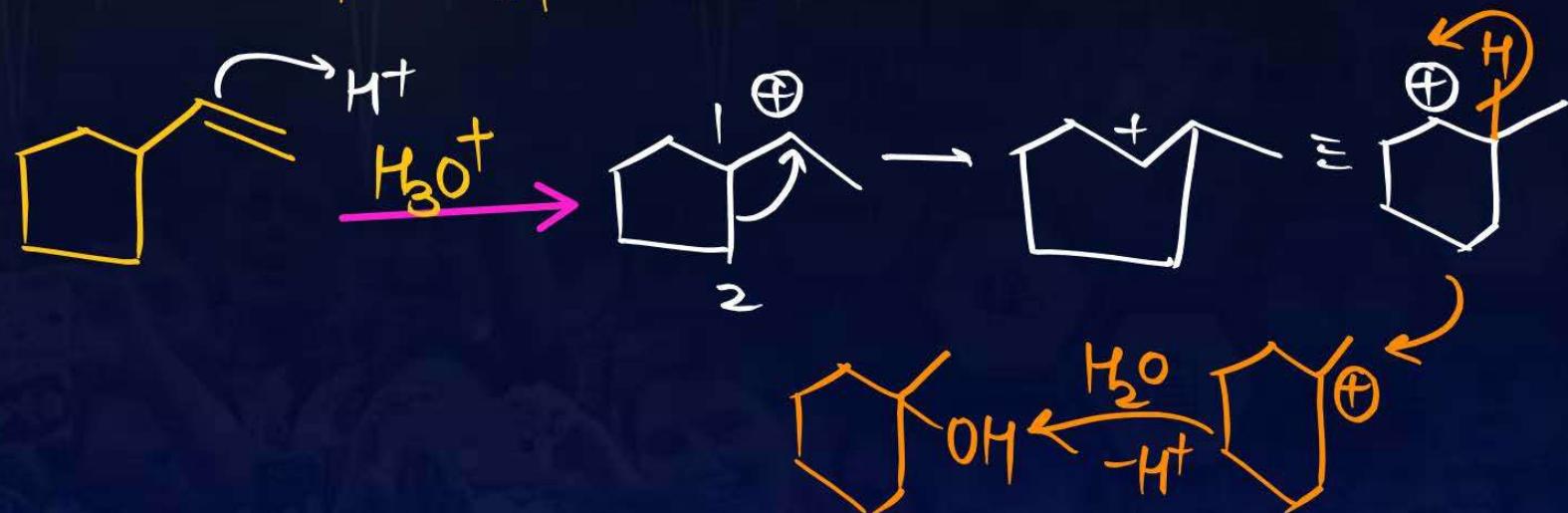
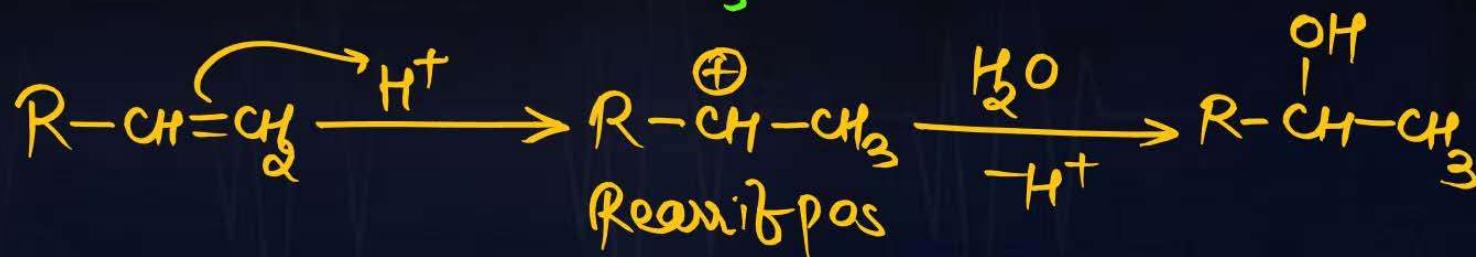
PW

The major products 'A' and 'B' respectively are:



6. Addition of water: (del H_2SO_4) (Same as HX)

or
 H^+ / H_2O
or
 H_3O^+



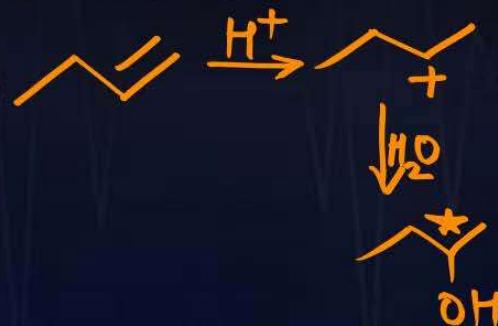
C.Q. 26

PW

Which of the following alkenes will give an optically active alcohol when treated with $\text{H}_2\text{O}/\text{H}_2\text{SO}_4$?

A

1-Butene



B

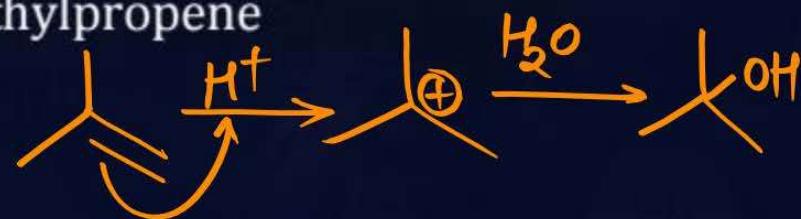
Ethene

C

Propene

D

2-Methylpropene

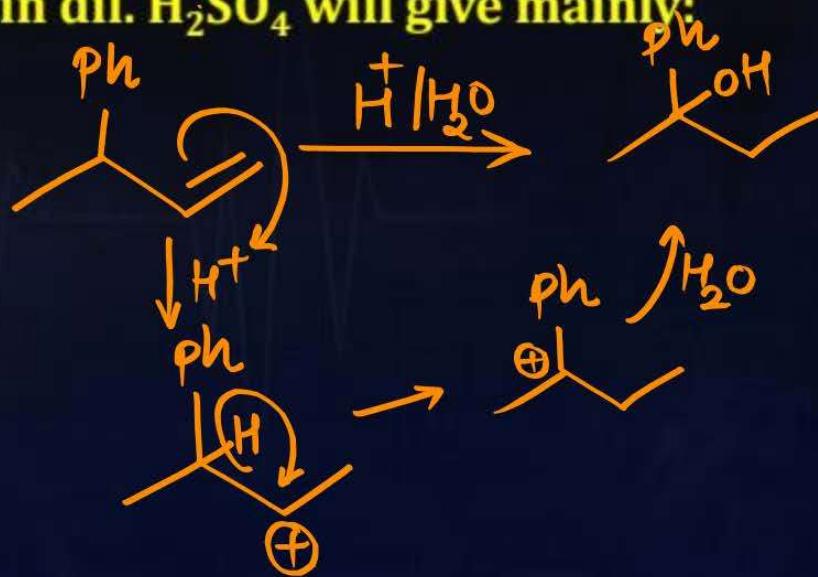


C.Q. 27

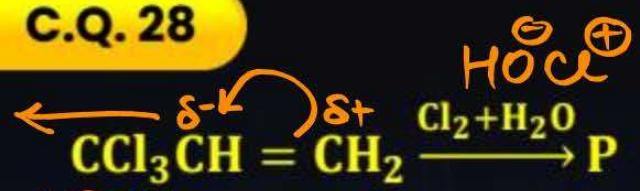
PW

Hydration of 3-phenyl but-1-ene in dil. H_2SO_4 will give mainly:

- A 3-Phenyl butan-1-ol
- B 3-Phenyl butan-2-ol
- C 2-Phenyl butan-2-ol
- D 2-Phenyl butan-1-ol

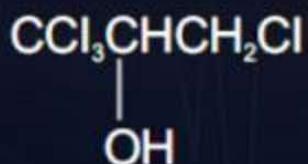


C.Q. 28

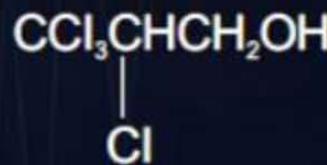


Identify major product 'P'.

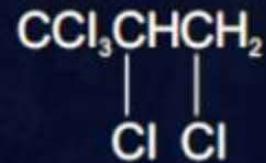
A



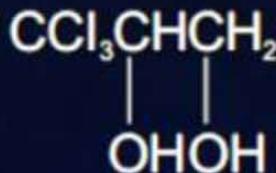
B



C



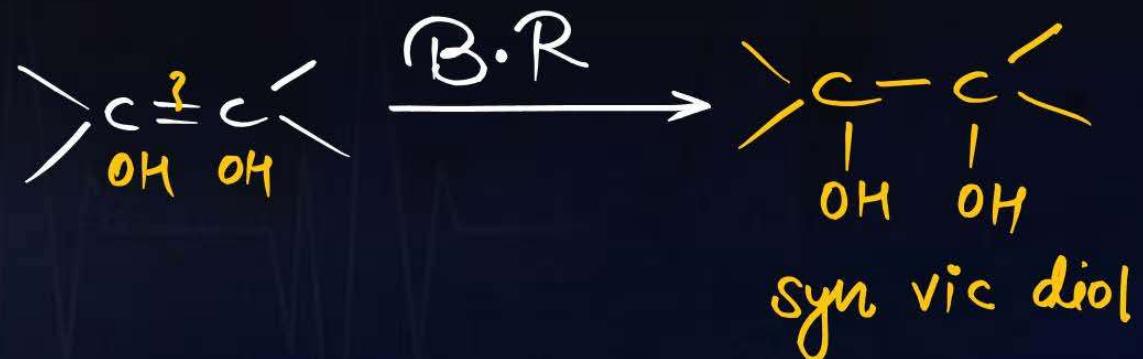
D

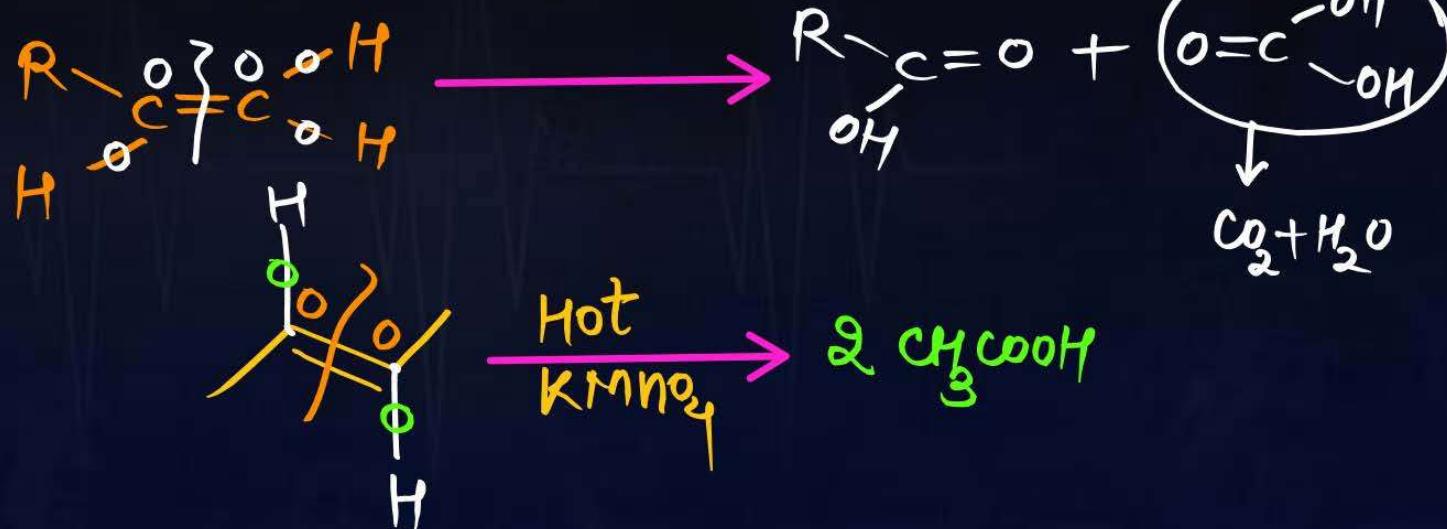


7. Oxidation: *Test for conservatism* purple \rightarrow delorise

A. Baeyer's Reagent:

dil + AlK MnO₄
Cold KMnO₄

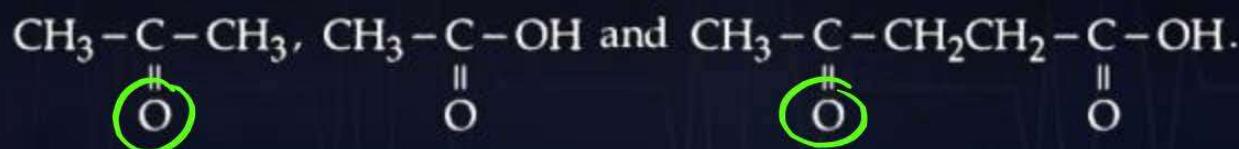


B. Acidic KMnO_4 :or
Hot KMnO_4 

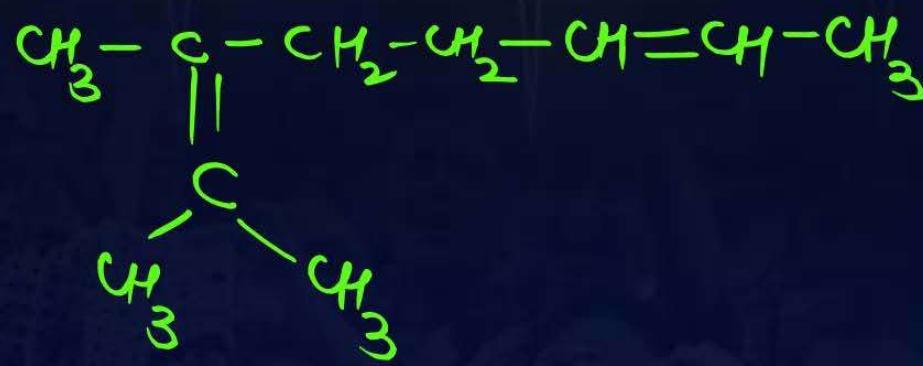
C.Q. 29 (JEE Mains 2025, 23 January Shift-2)



A compound 'X' absorbs 2 moles of hydrogen and 'X' upon oxidation with KMnO_4/H^+ gives

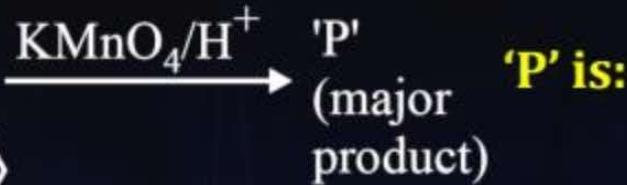
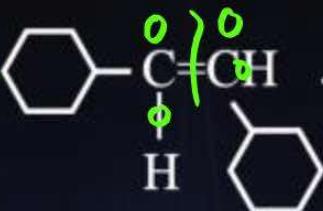


The total number of sigma bonds present in the compound 'X' is 27.

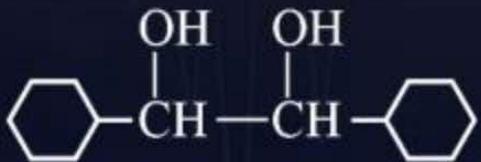


C.Q. 30 [NEET 2024]

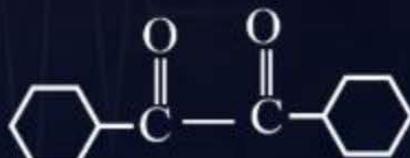
For the given reaction:



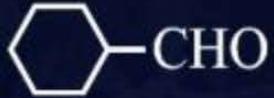
A



B



C



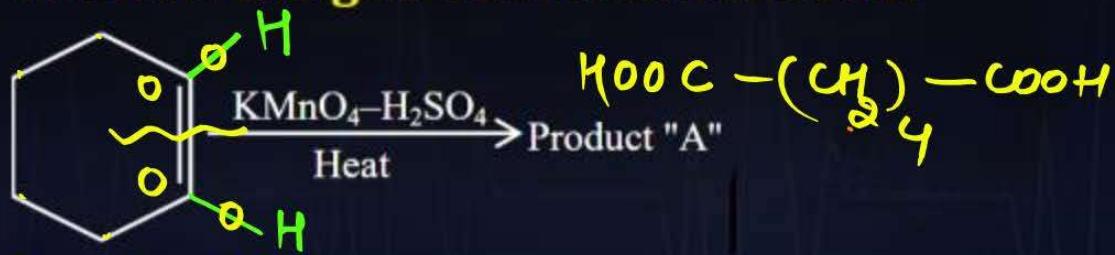
D



C.Q. 31 [NEET 2024]

PW

Consider the given chemical reaction:



Product "A" is:

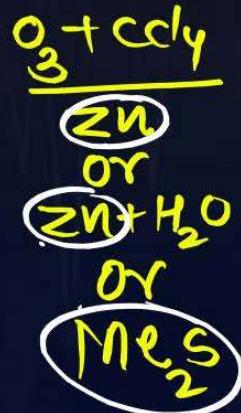
- A picric acid
- B oxalic acid
- C acetic acid
- D adipic acid

8. Ozonolysis:

① Reductive ozono



Reagent :-



② oxidative ozono (same as KMnO_4 , H^+)



Reagent

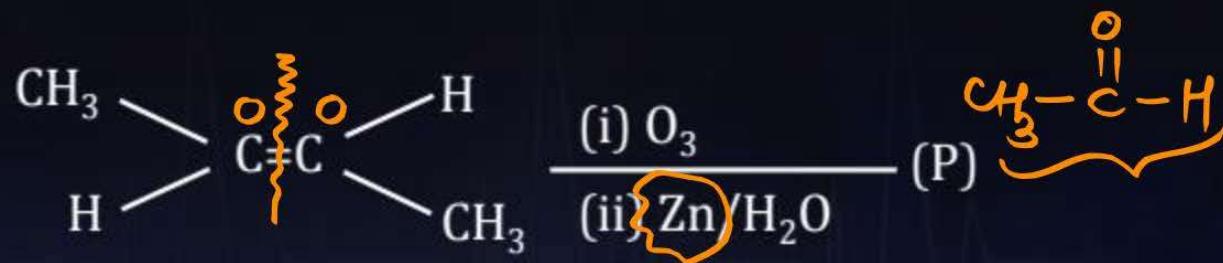


Molozonide



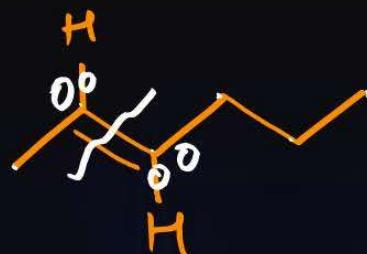
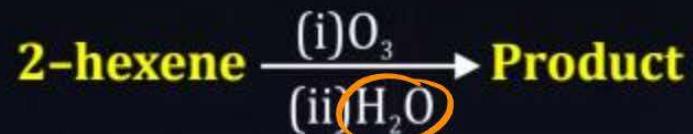
C.Q. 32 (JEE Mains 29 January 2024, Morning Shift)

P
W



Consider the given reaction. The total number of oxygen atoms present per molecule of the product (P) is 1.

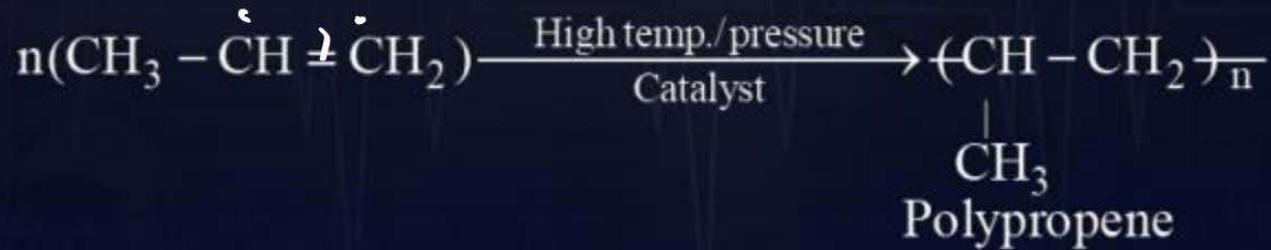
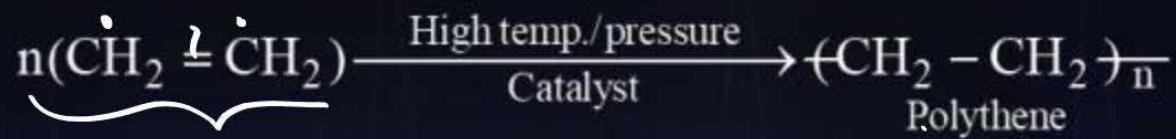
C.Q. 33 (12 April, JEE Mains 2023)

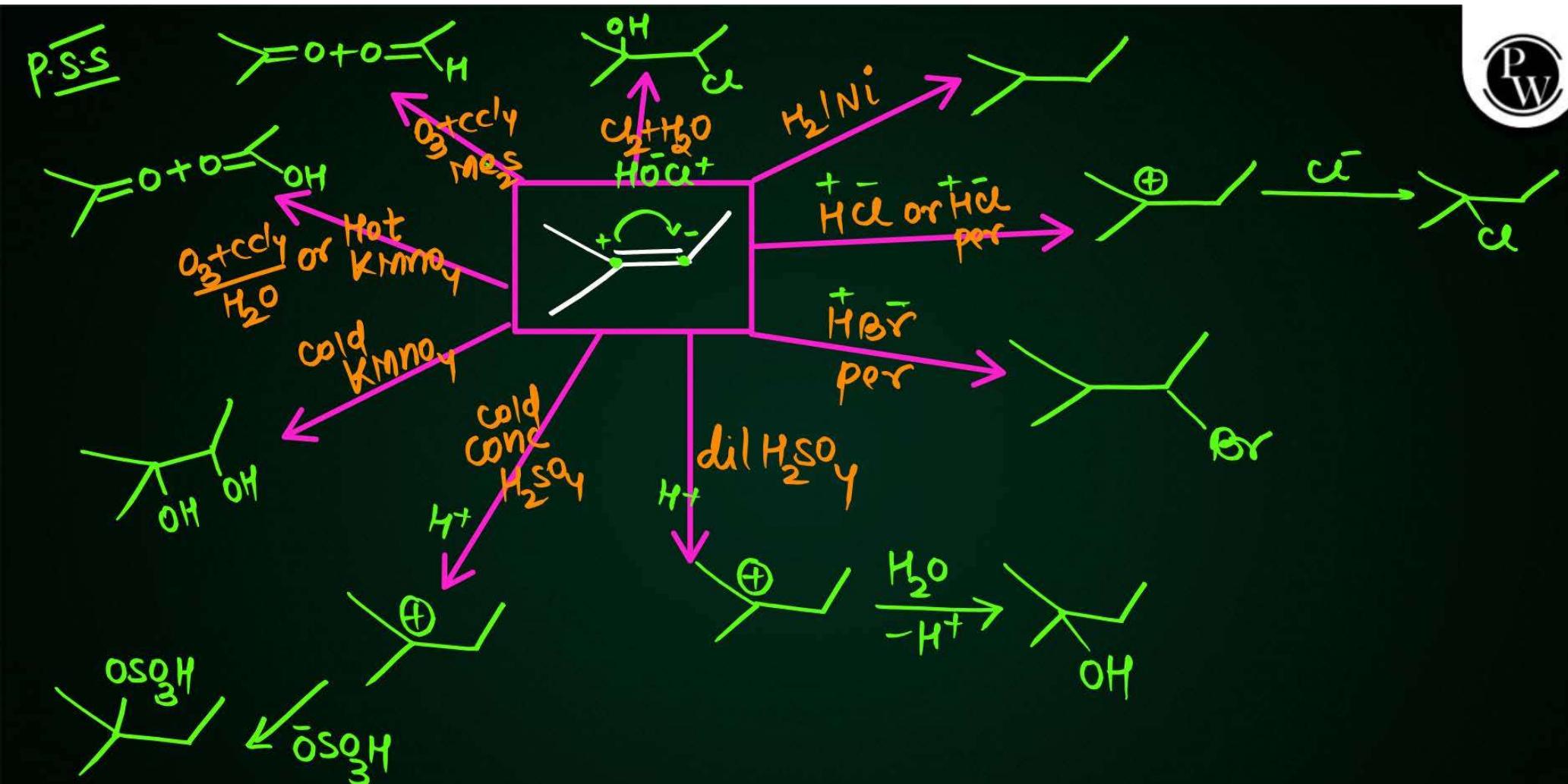


Two products formed in above reaction are: $CH_3COOH + CH_3CH_2CH_2COOH$

- A Butanoic acid and acetic acid
- B Butanal and acetic acid
- C Butanal and acetaldehyde
- D Butanoic acid and acetaldehyde

9. Polymerization:

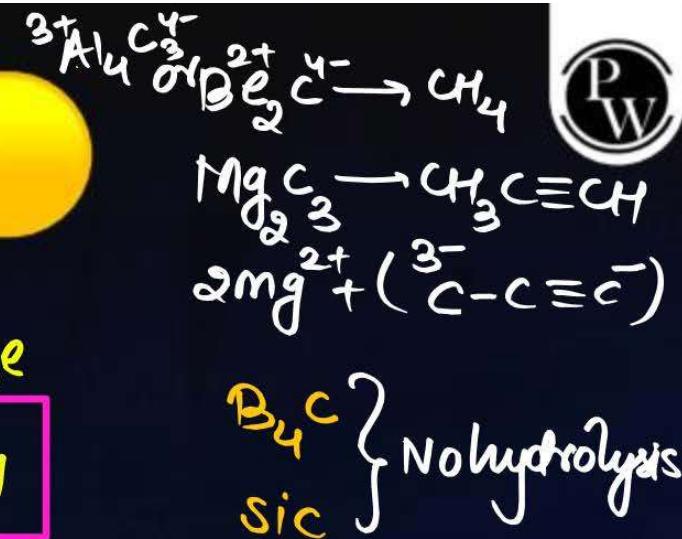
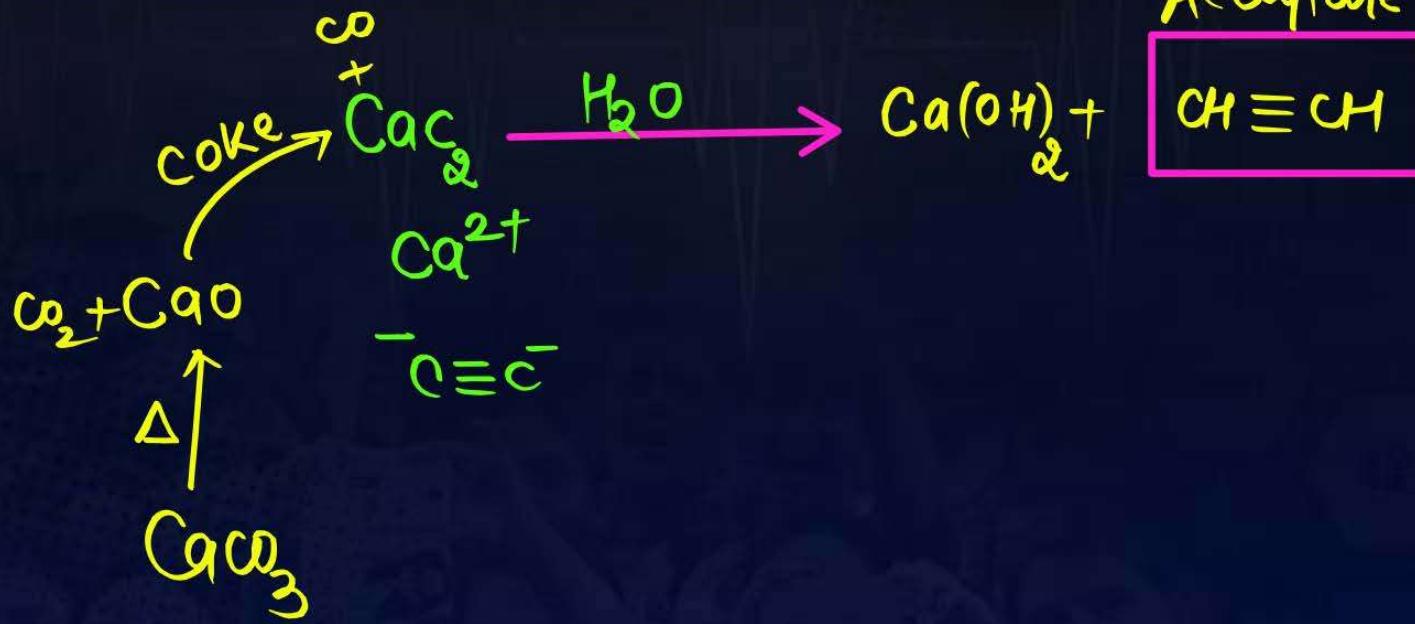






Methods of Preparation of Alkynes

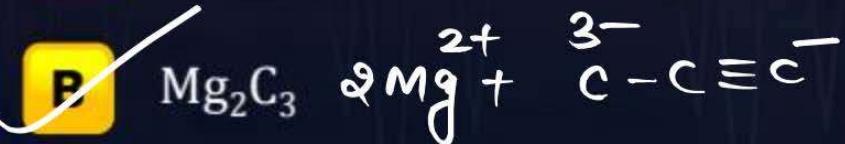
1. From calcium carbide:



C.Q. 34

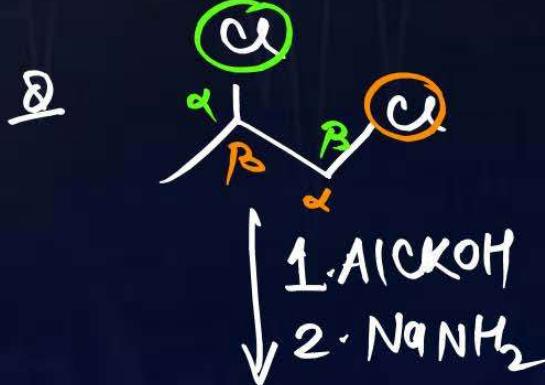
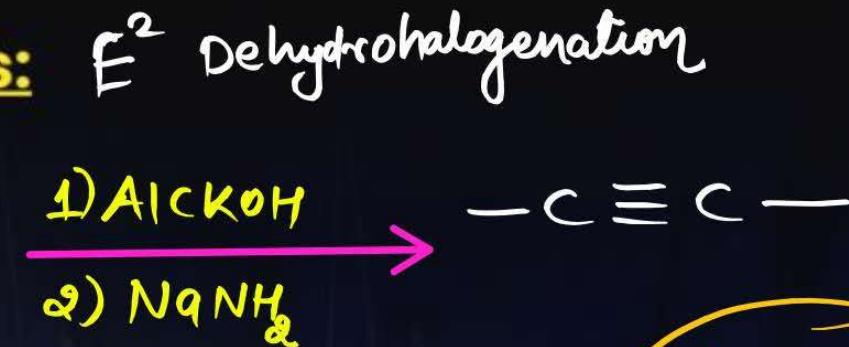
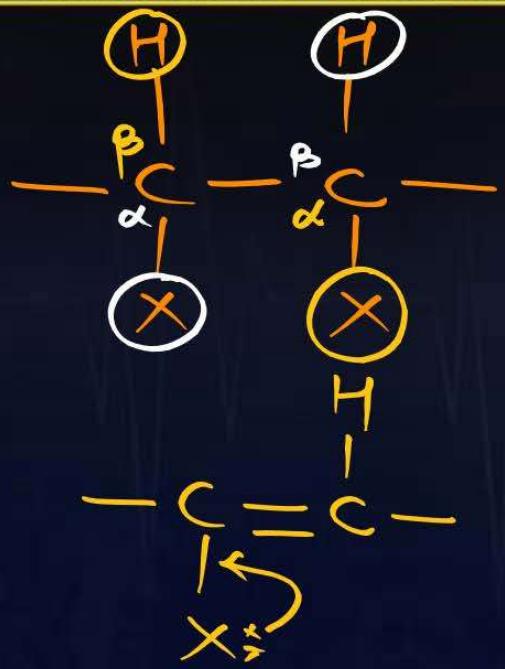


Which of the following gives propyne on hydrolysis?



2. From vicinal dihalides: E² Dehydrohalogenation

P
W



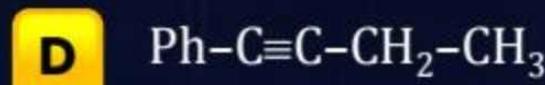
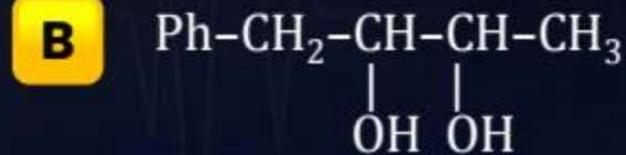
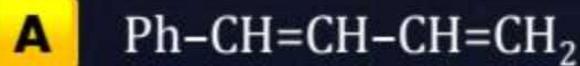
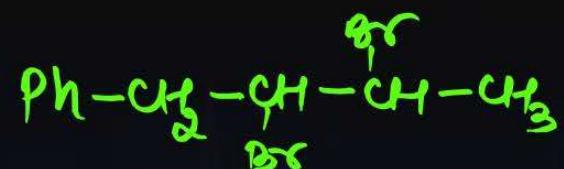
AlClKOH

AlClKOH + NaNH₂

NaNH₂

C.Q. 35 (AIIMS 2019)

PW

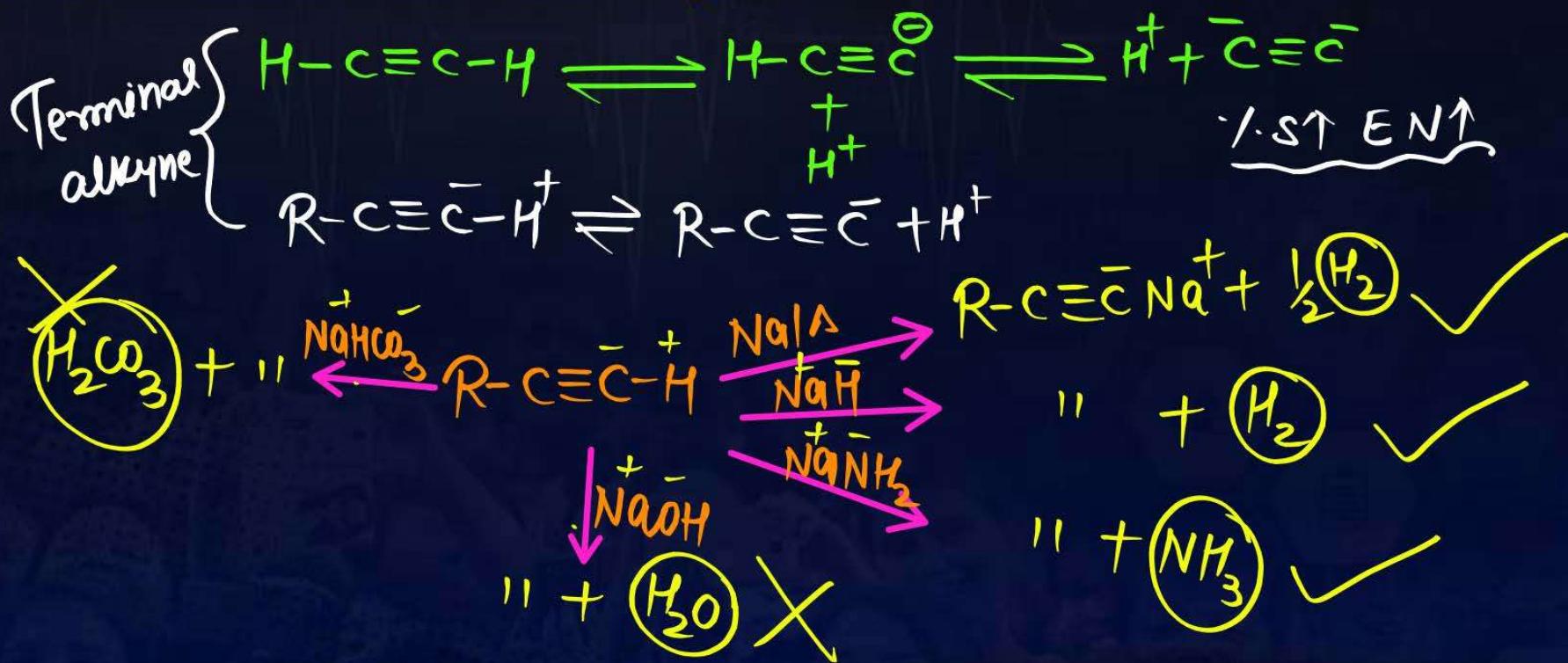




Chemical Properties of Alkynes

$R-C\equiv C-R'$ (Internal)

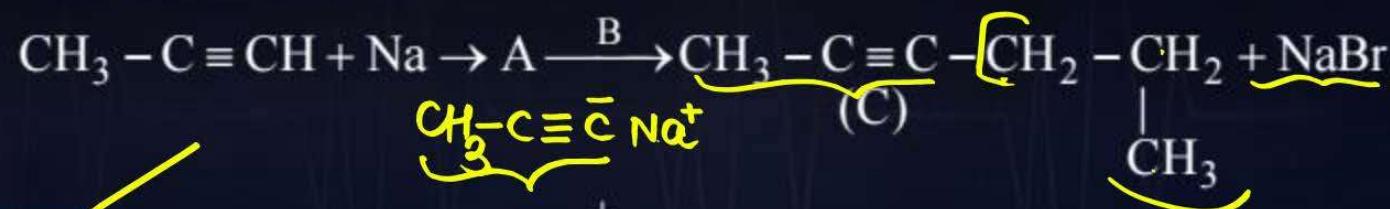
1. Acidic character of alkyne:



C.Q. 36



**Compound A formed in the following reaction reacts with B gives the product C.
Find out A and B.**



A

$$\text{A} = \text{CH}_3 - \text{C} \equiv \bar{\text{C}}\text{Na}, \text{B} = \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Br}$$

B

$$\text{A} = \text{CH}_3 - \text{CH} = \text{CH}_2, \text{B} = \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Br}$$

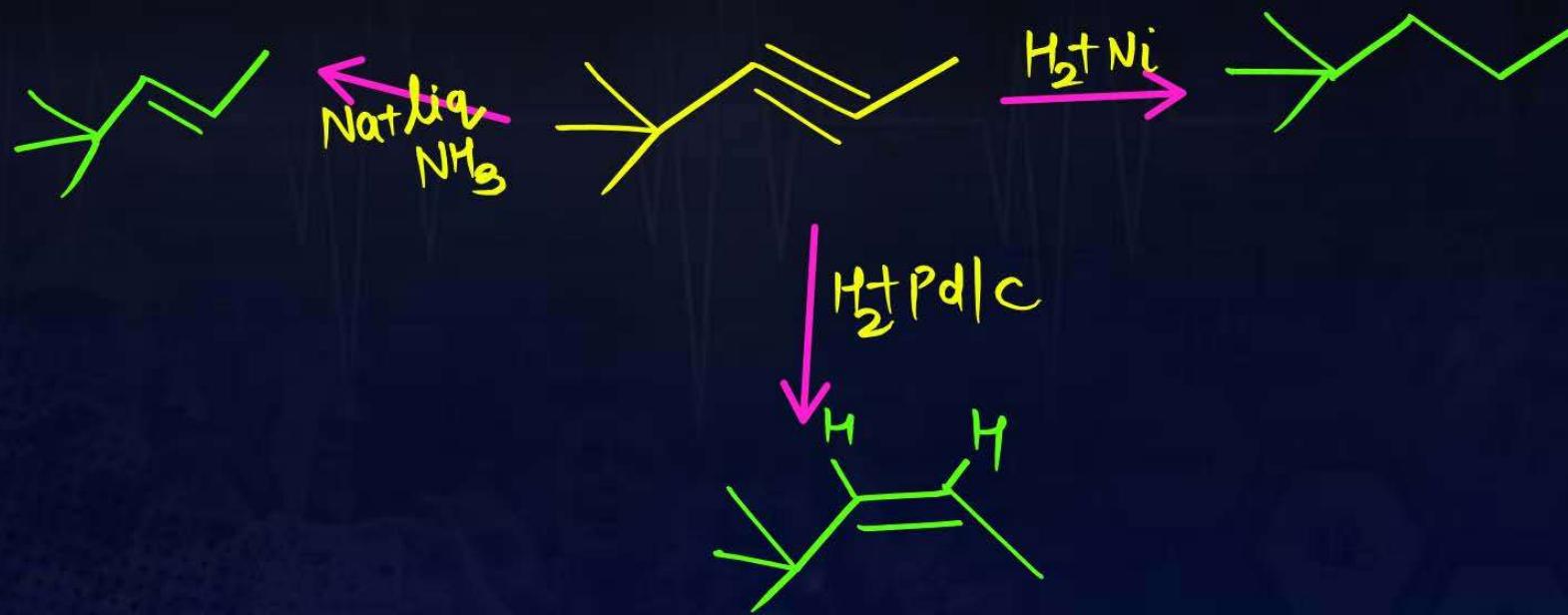
C

$$\text{A} = \text{CH}_3 - \text{CH}_2 - \text{CH}_3, \text{B} = \text{CH}_3 - \text{C} \equiv \text{CH}$$

D

$$\text{A} = \text{CH}_3 - \text{C} \equiv \bar{\text{C}}\text{Na}^+, \text{B} = \text{CH}_3 - \text{CH}_2 - \text{CH}_3$$

2. Addition of dihydrogen:



C.Q. 37 (JEE Mains 2025, 28 January Shift-2)



Identify product [A], [B] and [C] in the following reaction sequence.



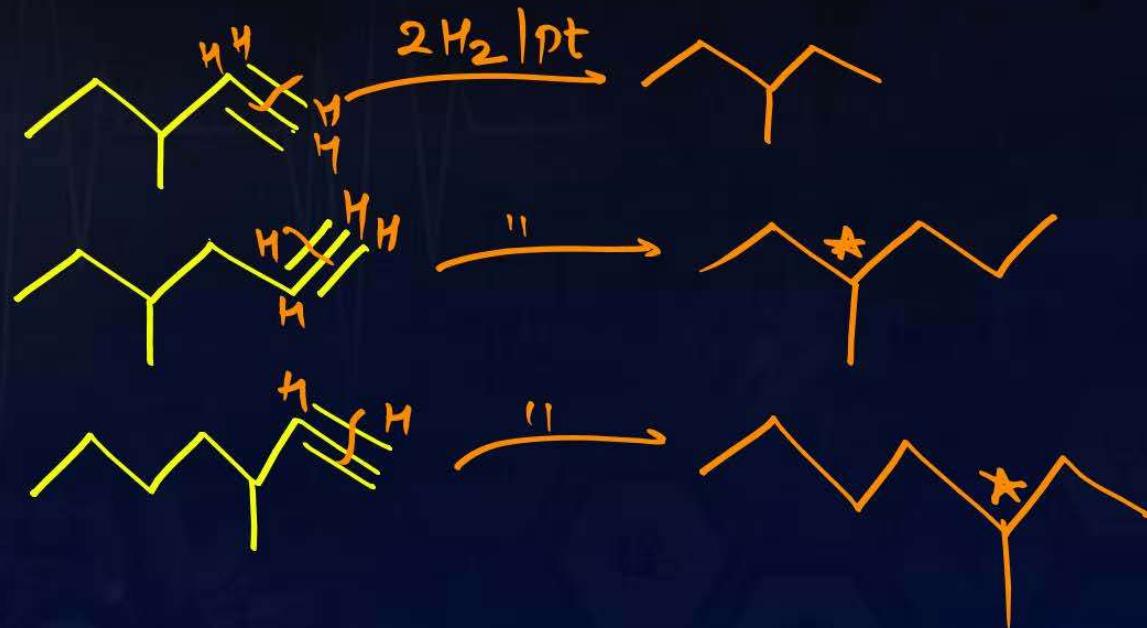
- A [A]: $\text{CH}_3\text{CH}_2\text{CH}_3$, [B]: CH_3CHO , [C]: HCHO
- B [A]: $\text{CH}_3\text{-CH=CH}_2$, [B]: CH_3CHO , [C]: HCHO
- C [A]: $\text{CH}_3\text{-CH=CH}_2$, [B]: CH_3CHO , [C]: $\text{CH}_3\text{CH}_2\text{OH}$
- D [A]: $\text{CH}_2=\text{CH}_2$, [B]: $\text{H}_3\text{C}-\overset{\text{O}}{\underset{\text{||}}{\text{C}}}-\text{CH}_3$, [C]: HCHO

C.Q. 38

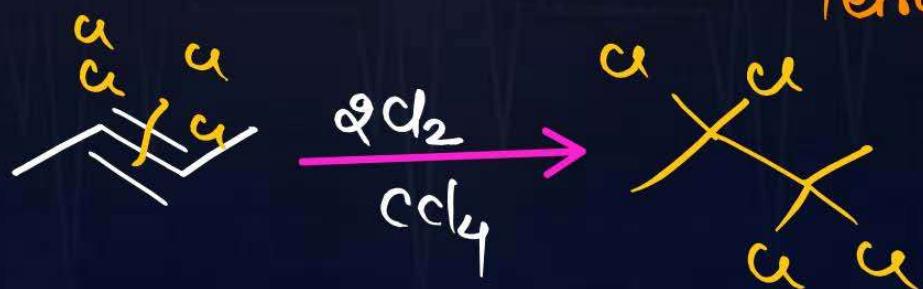
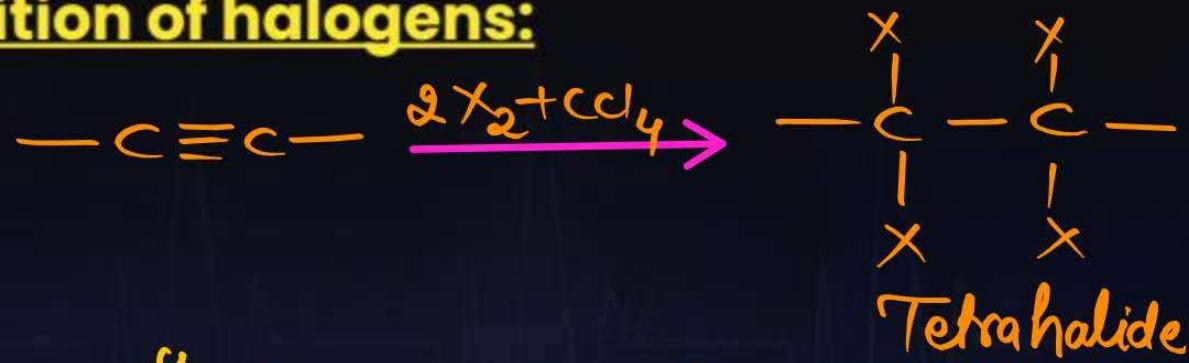


Which of the following alkyne on treatment with H_2 (2 mole)/Pt gives an optically inactive compound?

- A 3-Methyl-1-pentyne
- B 4-Methyl-1-hexyne
- C 3-Methyl-1-heptyne
- D None of the above

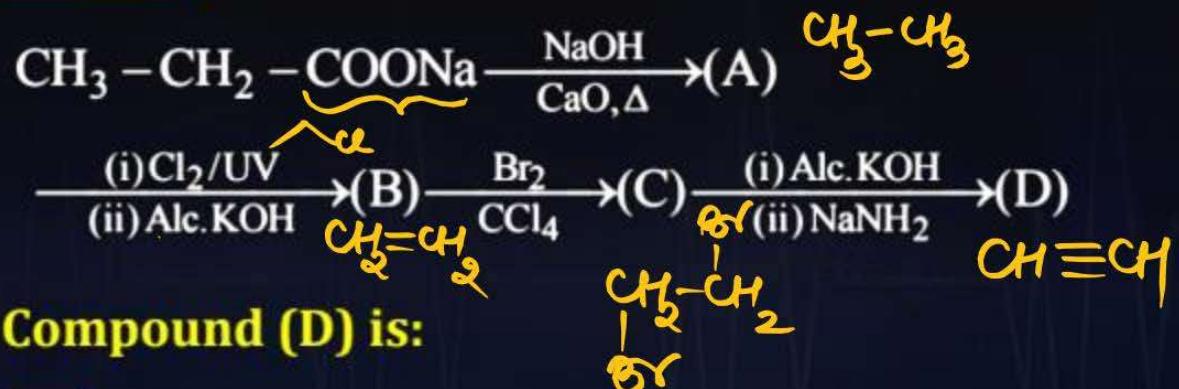


3. Addition of halogens:



C.Q. 39

PW



Compound (D) is:

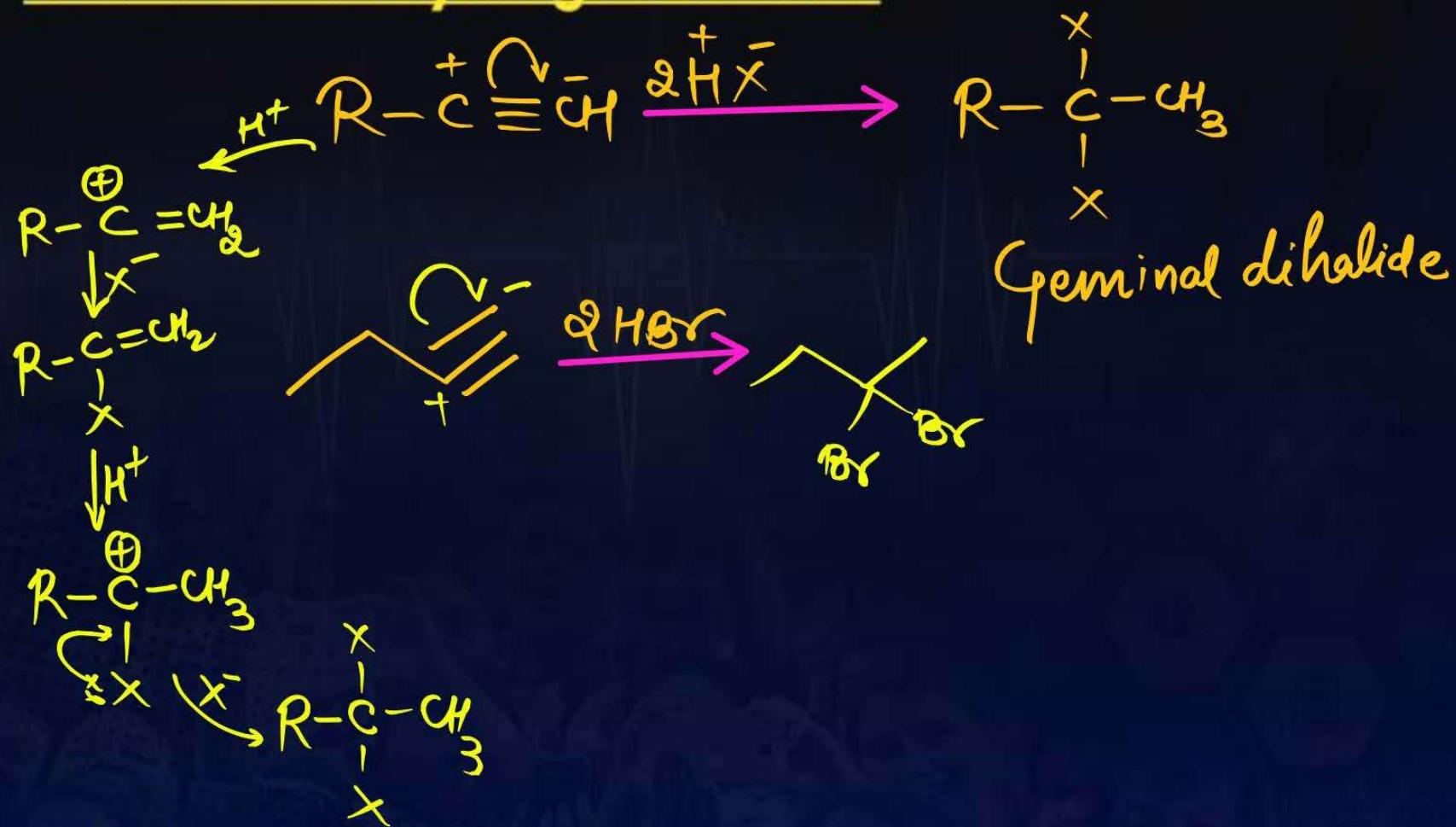
A C_2H_4

B C_2H_6

C C_2H_2

D C_4H_8

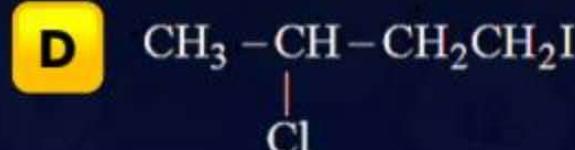
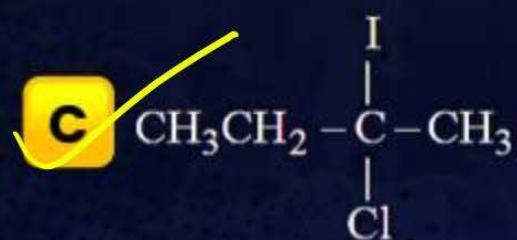
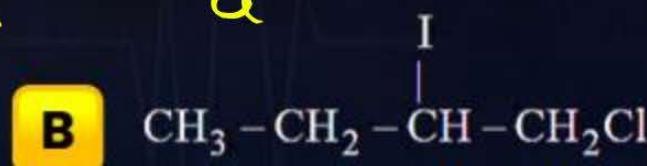
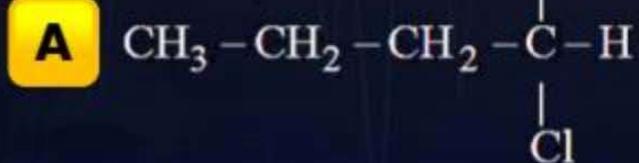
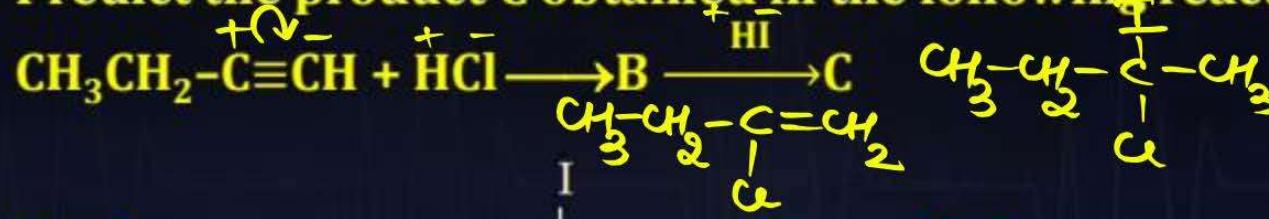
4. Addition of hydrogen halides:

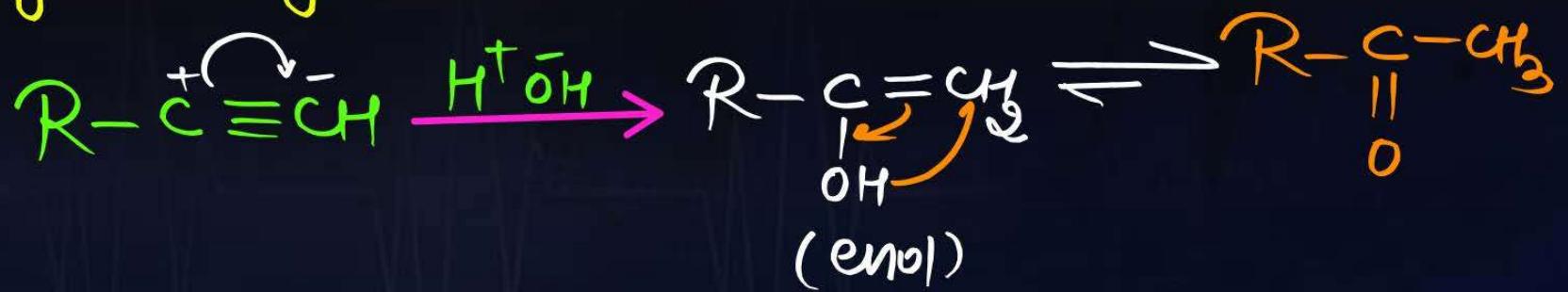


C.Q. 40 [AIPMT 2007]

PW

Predict the product C obtained in the following reaction of butyne-1:



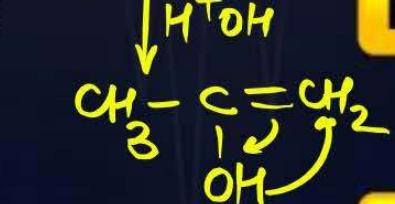
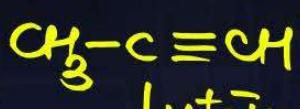
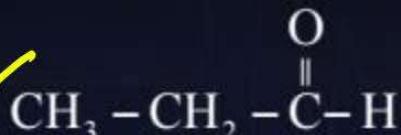
5. Addition of water: Kucherov rxn)Reagent: $\text{Hg}^{2+}/\text{H}_2\text{O}$ or dil $\text{HgSO}_4/\text{dil H}_2\text{SO}_4$ 

C.Q. 41 (24 Feb, JEE Mains 2021)



Which one of the following carbonyl compound cannot be prepared by addition of water on an alkyne in the presence of HgSO_4 and H_2SO_4 ?

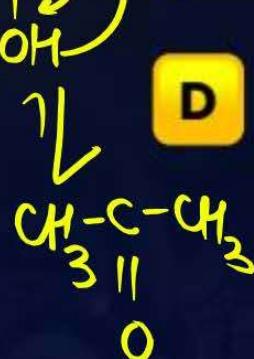
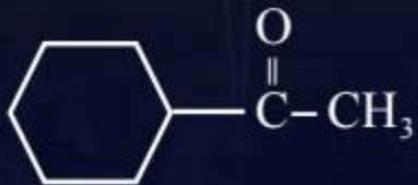
A



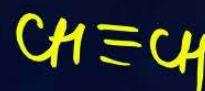
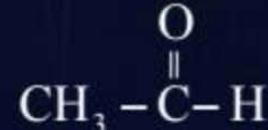
B



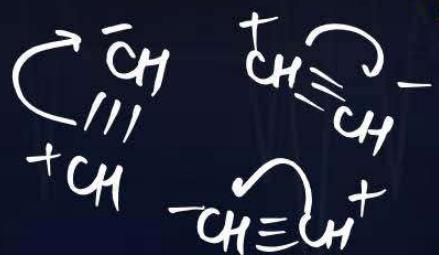
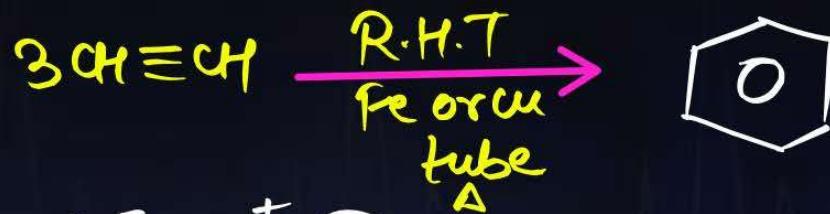
C

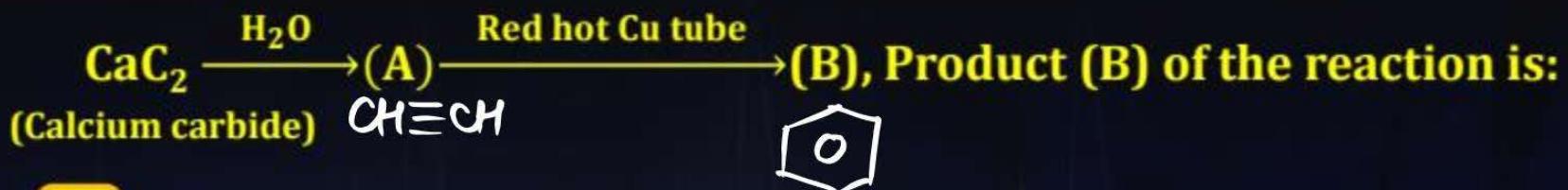


D



6. Cyclic Polymerizations:

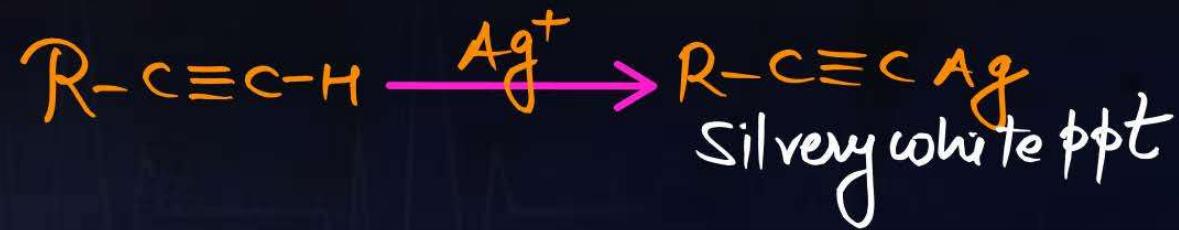


C.Q. 42**A** Toluene**B** Ethyl benzene**C** Benzene**D** Butyne

8. Test of Terminal alkynes:

A. Silver nitrate Test

$\text{AgNO}_3 + \text{NH}_4\text{OH}$
Ammoniacal
silver nitrate



B. Cuprous chloride test

$\text{Cu}_2\text{Cl}_2 + \text{NH}_4\text{OH}$



C.Q. 43 [AIPMT 2012]



Which of the following reagents will be able to distinguish between 1-butyne and 2-butyne?

- A NaNH_2 (Terminal alkyne)
- B HCl
- C O_2
- D Br_2

C.Q. 44 [AIPMT 1989]



Which is the most suitable reagent among the following to distinguish compound
(3) from rest of the compounds?

1. $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$
2. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
- (3) $\text{CH}_3 - \text{CH}_2\text{C} \equiv \text{CH}$**
4. $\text{CH}_3 - \text{CH} = \text{CH}_2$

A Bromine in carbon tetrachloride

B Bromine in acetic acid

C Alkaline KMnO_4

D Ammoniacal silver nitrate

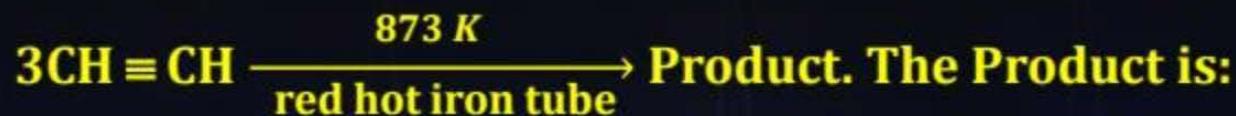


Methods of Preparation of Benzene

1. From ethyne:



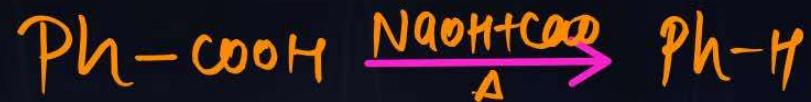
C.Q. 45



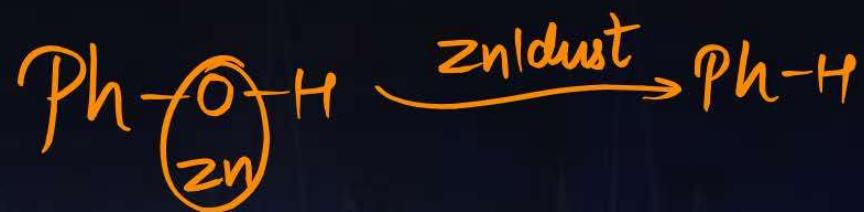
- A Hexyne
- C Benzene ✓

- B Hexene
- D Hexane

2. Decarboxylation of aromatic acids:



3. Reduction of Phenol:



C.Q. 46



When phenol is distilled with zinc dust. the main product is:

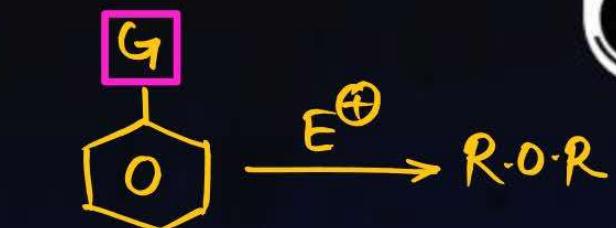
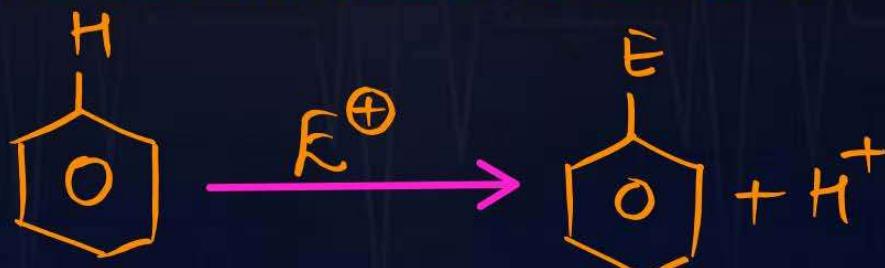
- A biphenyl
- B benzene ✓
- C benzaldehyde
- D phenolphthalein



Chemical Properties of Benzene

PW

Electrophilic Substitution Reactions:



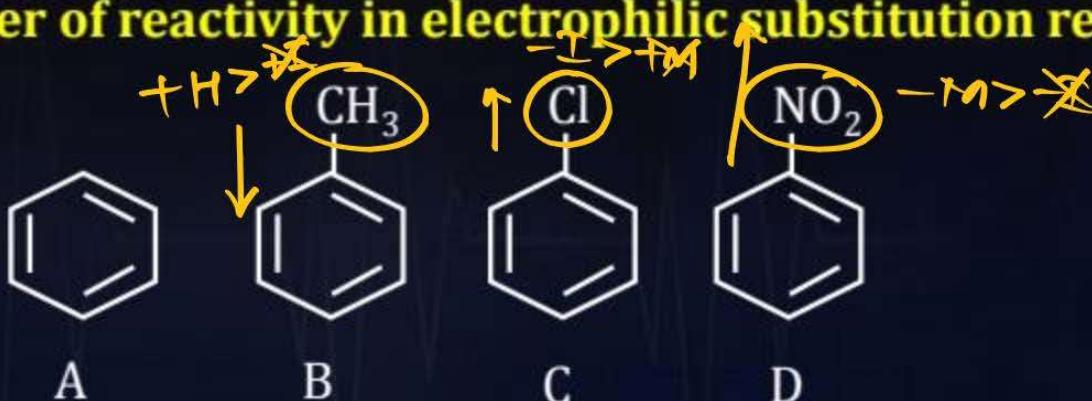
R-O-R depends on
dominating effect of G



C.Q. 47 (JEE Mains 31 January 2024, Evening Shift)

PW

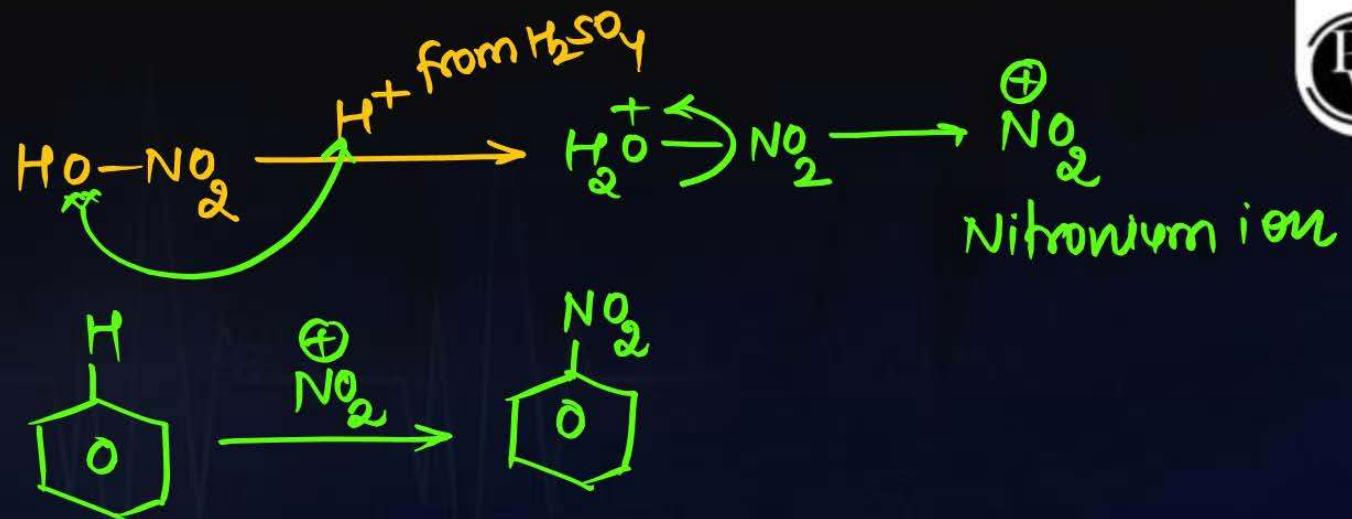
The correct order of reactivity in electrophilic substitution reaction of the following compounds is:



- A B > C > A > D
- B D > C > B > A
- C A > B > C > D
- D B > A > C > D

1. Nitration:

Reagent Conc HNO_3
+
Conc H_2SO_4



C.Q. 48 (24 June, JEE Mains 2022 Shift II)

PW

In the given reaction sequence, the major product 'C' is:

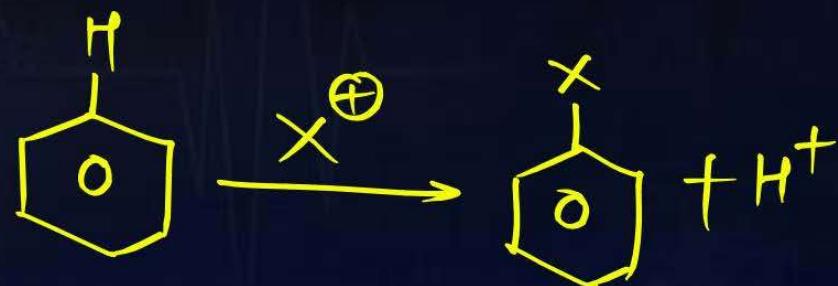
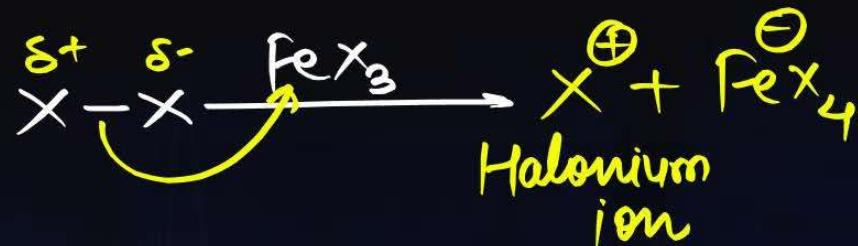


Benzene on nitration gives nitrobenzene in presence of HNO_3 and H_2SO_4 mixture where:

- A Both H_2SO_4 and HNO_3 act as a bases.
- B Both H_2SO_4 and HNO_3 act as an acids.
- C HNO_3 acts as a base and H_2SO_4 acts as an acid
- D HNO_3 acts as an acid and H_2SO_4 acts as a base.

2. Halogenation:

Reagent X_2 + Anhy Fe or FeX_3

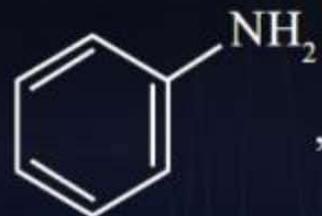


C.Q. 50 [NEET 2022]



Which of the following is suitable to synthesize chlorobenzene?

A



, HCl Heating

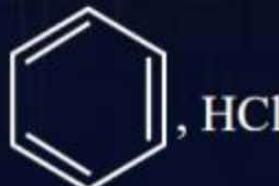
B

Benzene, Cl₂, anhydrous FeCl₃

C

Phenol, NaNO₂, HCl, CuCl

D



, HCl

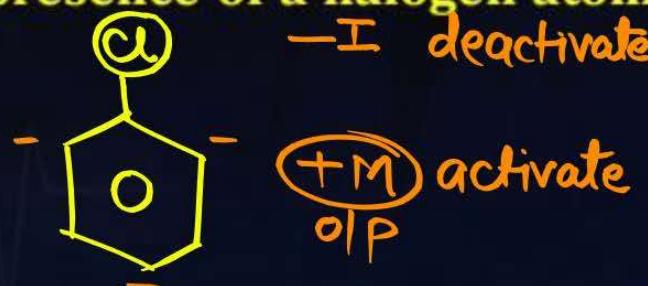


C.Q. 51



For an electrophilic substitution reaction, the presence of a halogen atom in the benzene ring ____.

- A deactivates the ring by inductive effect.
- B deactivates the ring by resonance.
- C decreases the charge density at ortho and para position relative to meta position by resonance.
- D directs the incoming electrophile to meta position by increasing the charge density relative to ortho and para position.



3. Sulphonation:

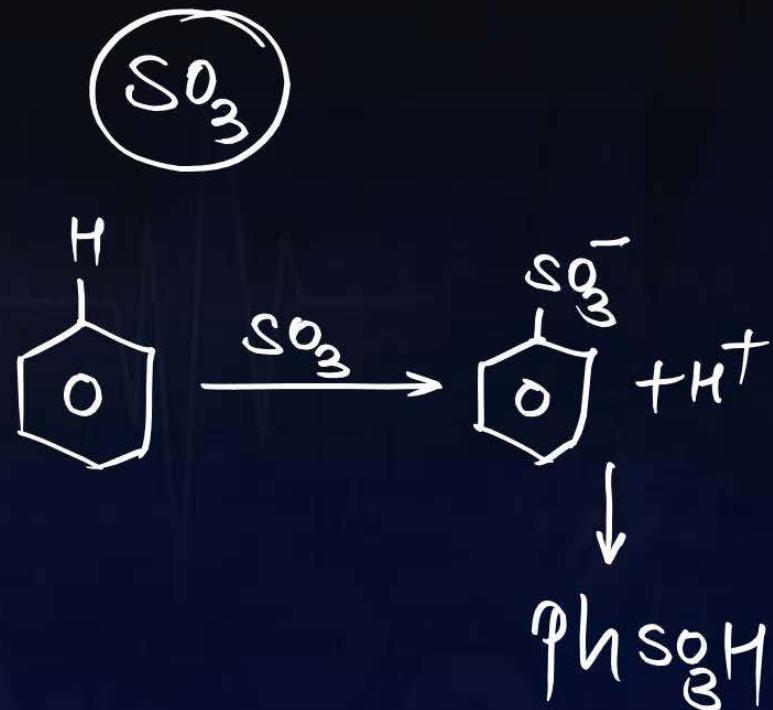
Reagent



fuming H_2SO_4



conc H_2SO_4



C.Q. 52 (AIIMS 2007)

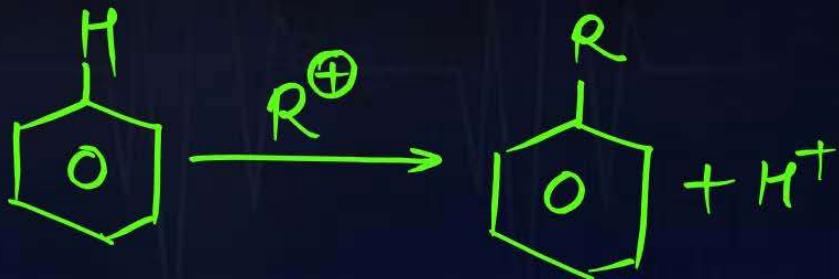
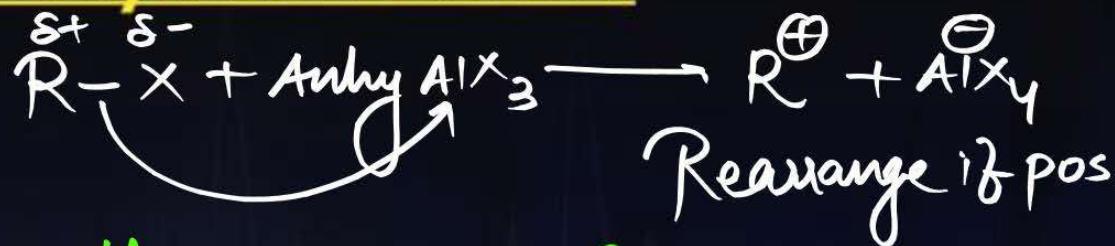


Which of the following species participate in sulphonation of benzene ring?



4. Friedel-Crafts alkylation reaction:

Reagent

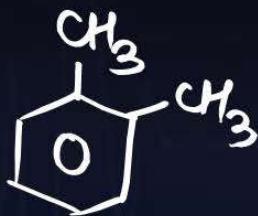


C.Q. 53 [NEET 2013]

PW

Which of the following compounds will not undergo Friedal-Craft's reaction easily:

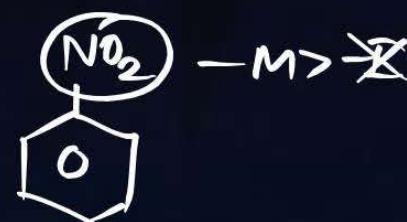
A o-Xylene



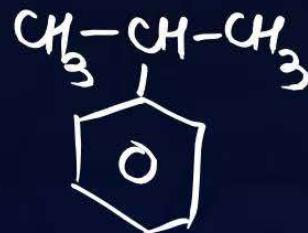
C Toluene



B Nitrobenzene



D Cumene



For the formation of toluene by Friedal Craft reaction, reactants used in presence of anhydrous AlCl_3 are:

A C_2H_2 and CCl_4

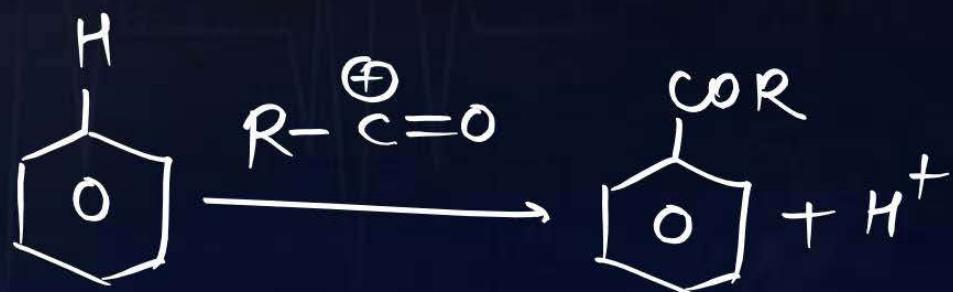
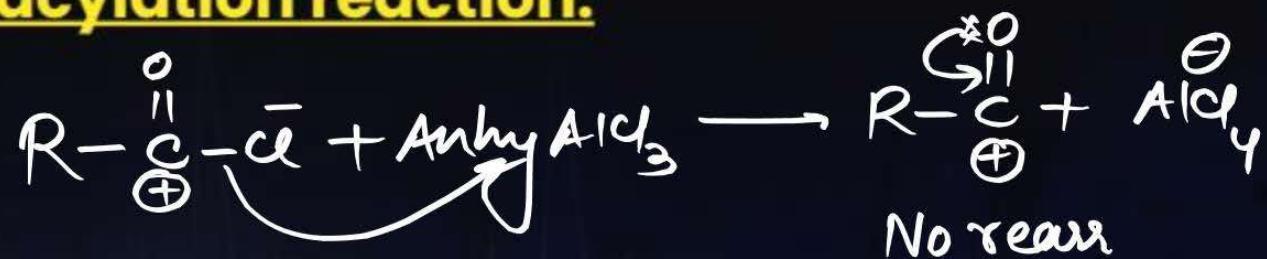
B CH_4 and $\text{Ca}(\text{CN})_2$

C C_6H_6 and CH_3Cl

D $\text{C}_2\text{H}_5\text{OH}$ and Zn

5. Friedel-Crafts acylation reaction:

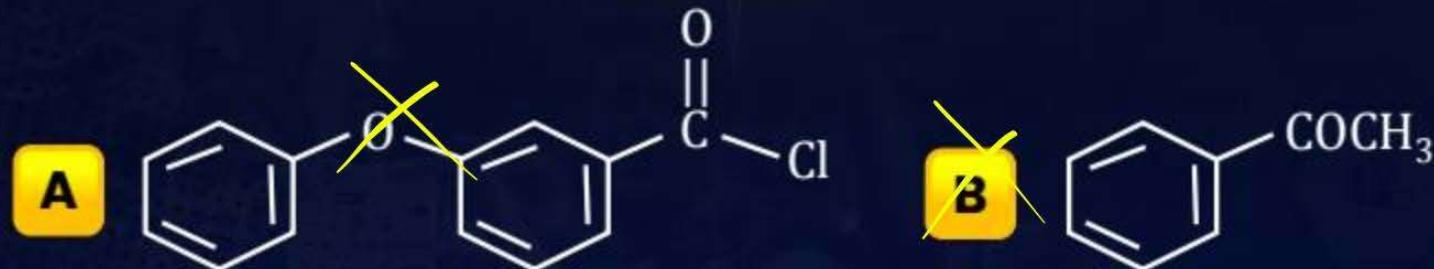
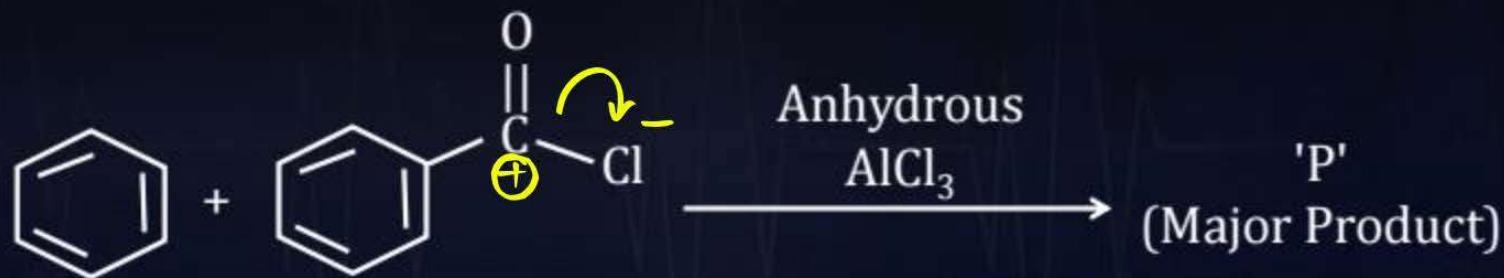
Reagent

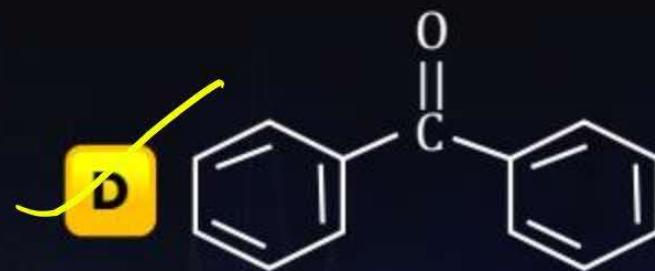
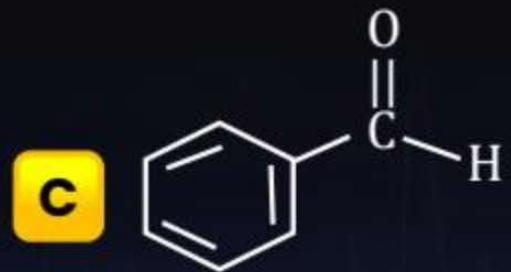


C.Q. 55 [NEET 2013]

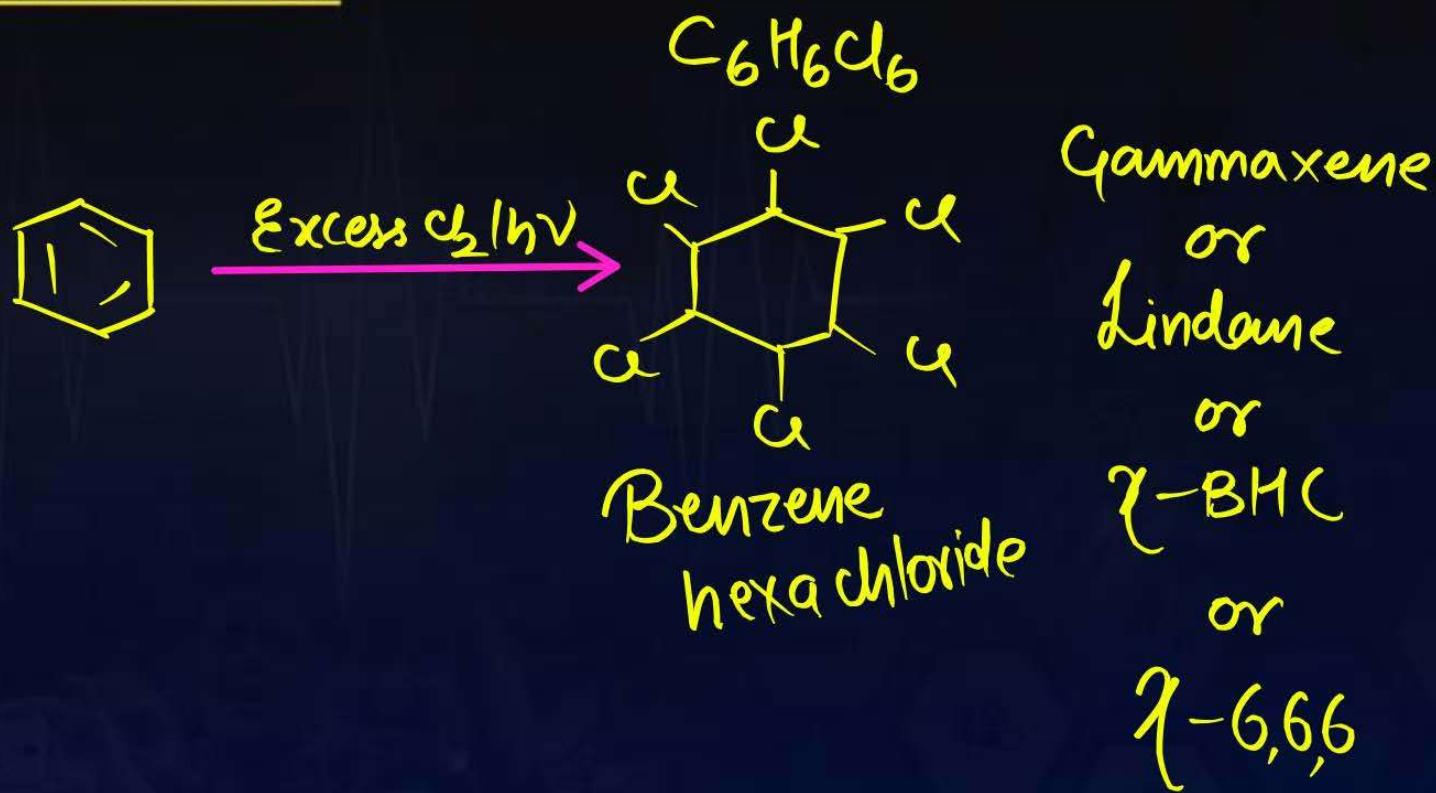
PW

Identify major product 'P' formed in the following reaction.

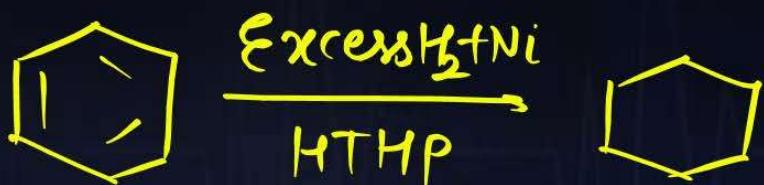




6. Addition of chlorine:



7. Addition of hydrogen:

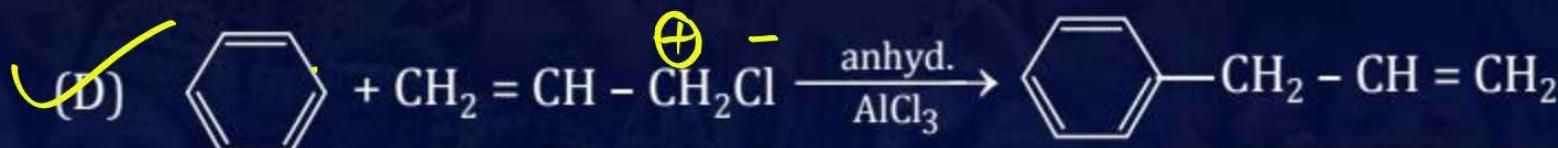
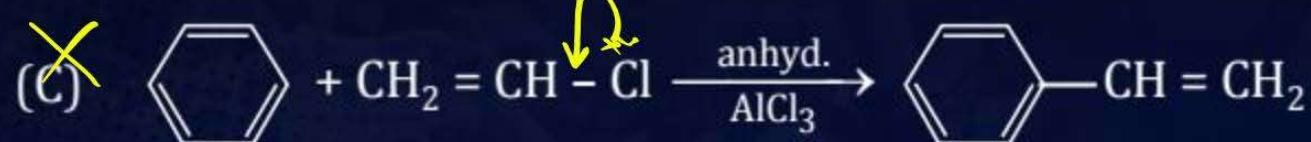
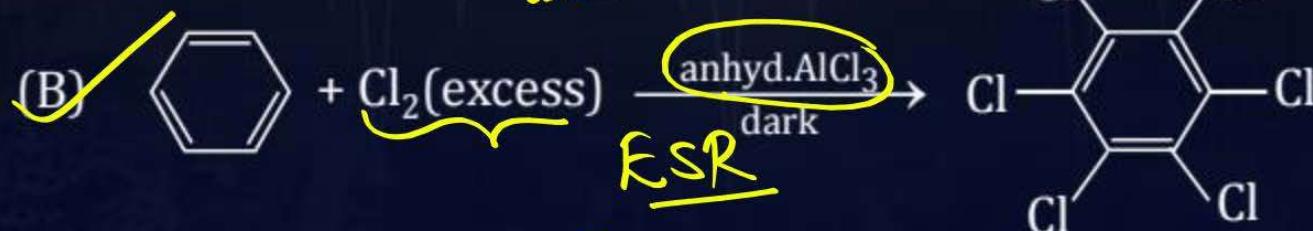


C.Q. 56 (07 Jan, JEE Mains 2020)

PW

Consider the following reactions:

Which of these reactions are possible?



A

(B) and (D)

B

(A) and (D)

D

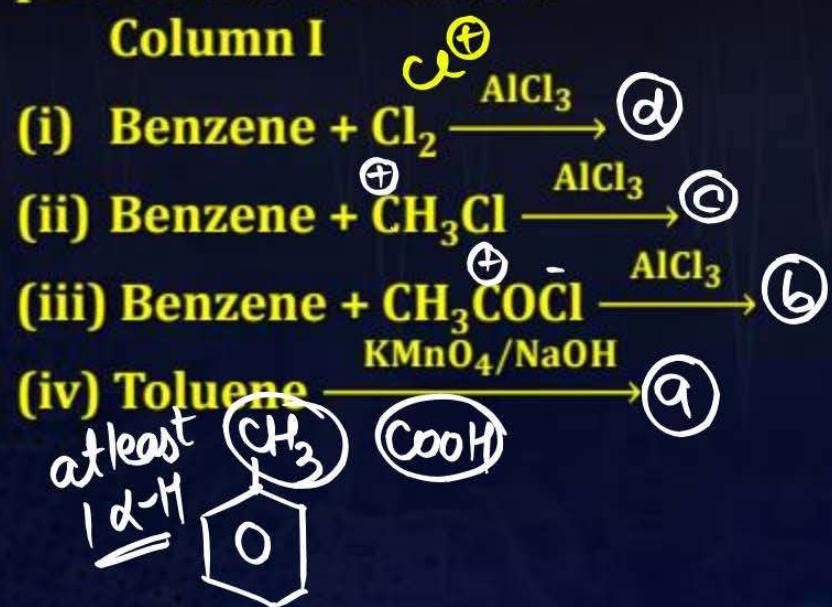
(B), (C) and (D)

C

(A) and (B)

Match the following reactants in Column I with the corresponding reaction products in Column II.

Column I



Column II

- (a) Benzoic acid
- (b) Methyl phenyl ketone
- (c) Toluene
- (d) Chlorobenzene
- (e) Benzene hexachloride

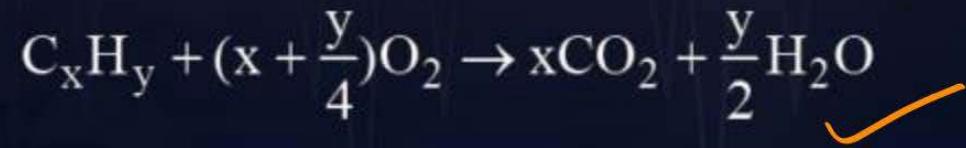
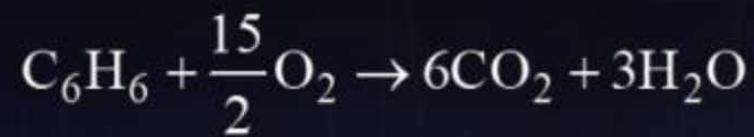
C.Q. 58 (AIIMS 1999)



The product obtained by treating benzene with chlorine in presence of ultraviolet light is:

- A CCl_4
- B $\text{C}_6\text{H}_5\text{Cl}$
- C $\text{C}_6\text{H}_6\text{Cl}_6$
- D C_6Cl_6

8. Combustion:

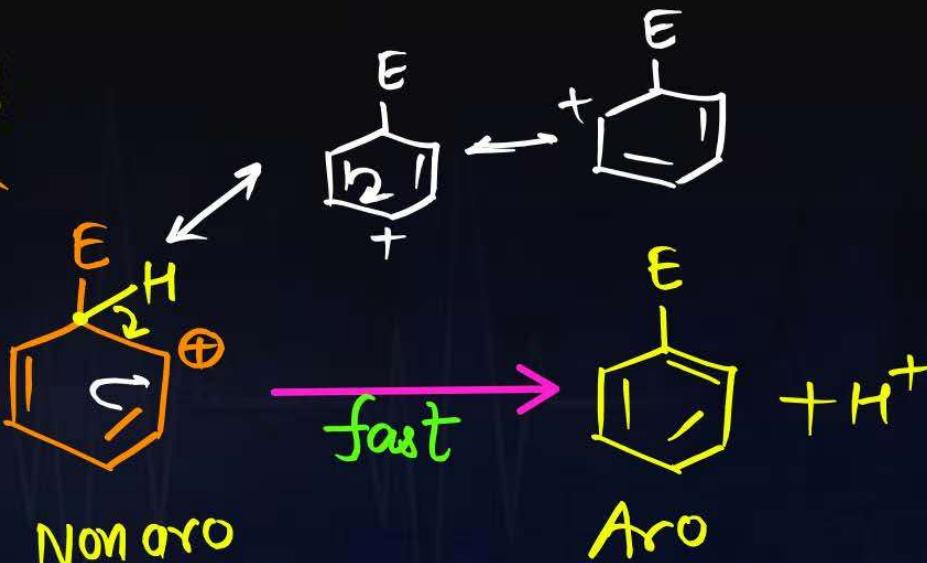


Mechanism of E.A.S:

OR
E-S-R



Aro



Wheland intermediate

Resonance hybrid

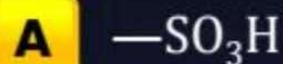
σ -Complex



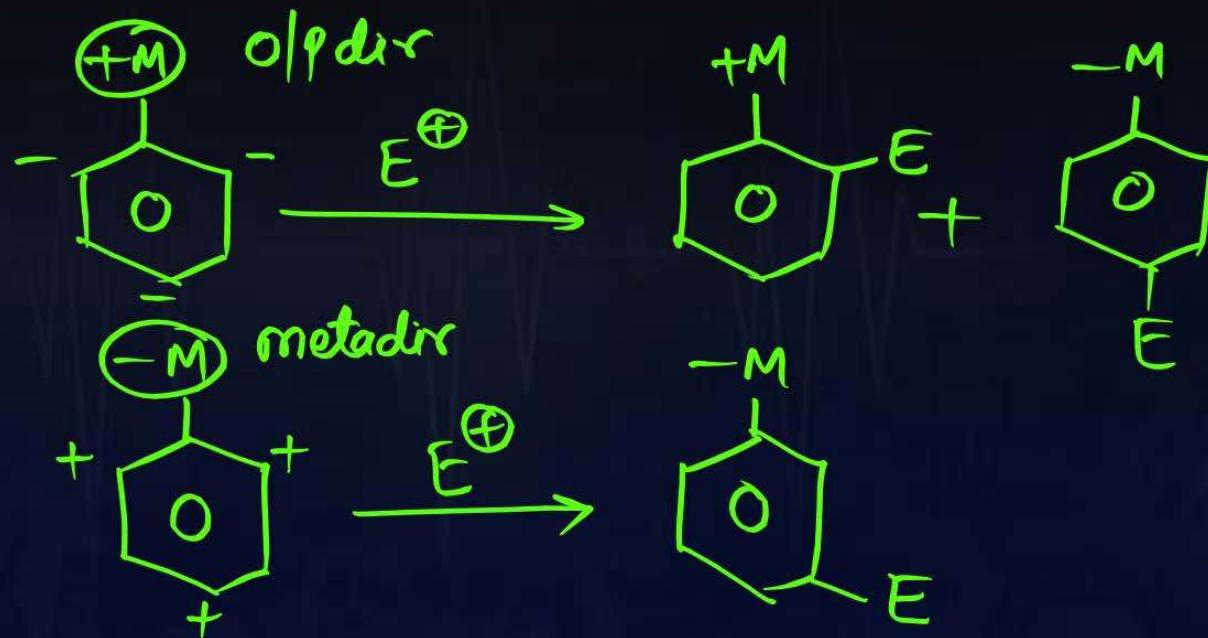
C.Q. 59 [NEET 2013]



Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating?



$-\text{M}$
meta dir

Directive influence of a functional group in monosubstituted benzene:

C.Q. 60 (JEE Mains 2025, 22 January Shift-2)



The compound with molecular formula C_6H_6 , which gives only one monobromo derivative and takes up four moles of hydrogen per mole for complete hydrogenation has $\textcircled{8}$... π electrons. $(4\pi \text{ bond})$
 $8\pi e^-$





Practice Problems

QUESTION-1



Catalytic hydrogenation of benzene at high temperature and pressure forms:

- A xylene
- B cyclohexane ✓
- C benzoic acid
- D toluene

QUESTION-2

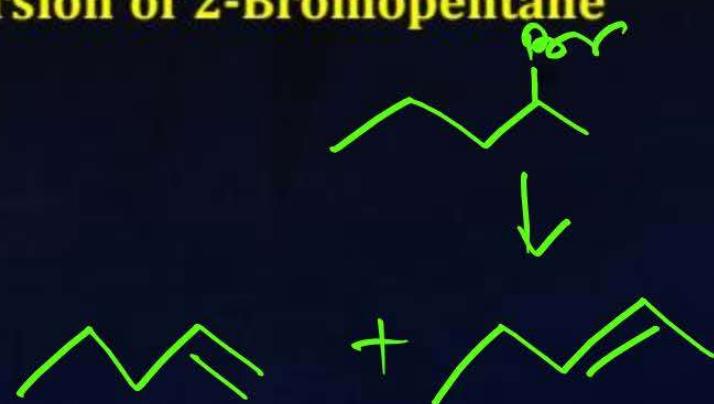


Consider the statements given below for the conversion of 2-Bromopentane to form pent-2-ene and pent-1-ene.

- A. Pent-2-ene is the major product
- B. It is dehydrohalogenation reaction
- C. It is dehydration reaction

The correct statement(s) is/are:

- A** A, B and C
- B** A and B
- C** A and C
- D** B and C



QUESTION-3



Which one of the following is not prepared by Wurtz reaction?



QUESTION-4



In which of the following, anti-Markovnikov addition of HBr is not observed?

- A Propene 
- B But-1-ene 
- C But-2-ene 
- D Pent-2-ene 

QUESTION-5



Higher alkanes can be converted to a mixture of lower alkanes by:

- A hydrolysis
- B oxidation
- C pyrolysis
- D distillation under reduced pressure

QUESTION-6



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

Assertion A: Boiling point of alkanes increases with increase in molecular weight.

Reason R: Van der Waals forces decrease with increase in molecular weight.

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

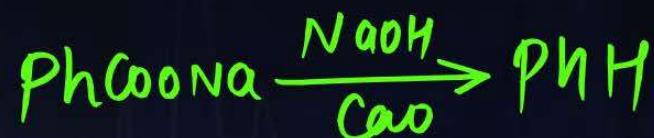
- A** A is true but R is false. 
- B** A is false but R is true.
- C** Both A and R are true and R is the correct explanation of A.
- D** Both A and R are true but R is NOT the correct explanation of A.

QUESTION-7



Sodium salt of benzoic acid on heating with soda lime gives:

- A Cyclohexanol
- B Benzoic acid
- C Benzene
- D Benzaldehyde

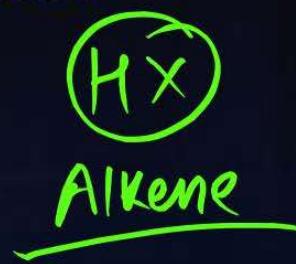


QUESTION-8



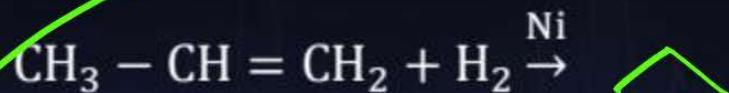
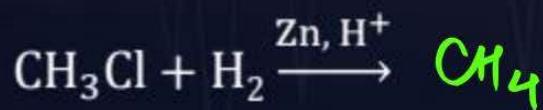
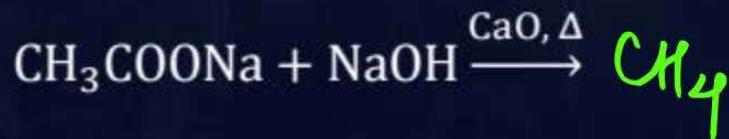
Addition of hydrogen halides to alkene is an example of:

- A Electrophilic addition reaction
- B Nucleophilic addition reaction
- C Electrophilic substitution reaction
- D Nucleophilic substitution reaction



QUESTION-9

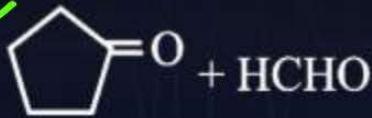
Which of the following reaction forms propane?

A**B****C****D**

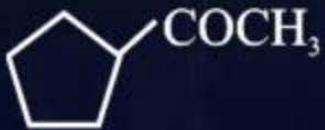
QUESTION-10



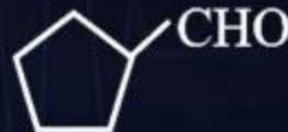
A



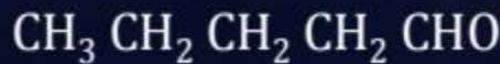
C



B



D



QUESTION-11

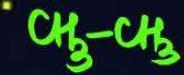
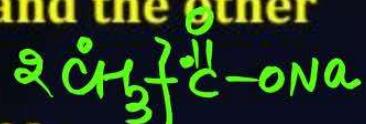


Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R

~~Assertion A:~~ Sodium acetate on Kolbe's electrolysis gives methane.

~~Reason R:~~ Methyl free radical is formed at anode.

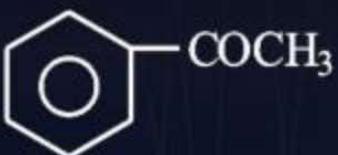
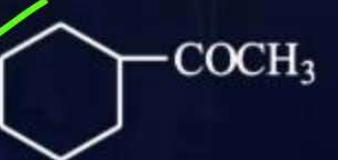
In the light of the above statements, choose the correct answer from the options given below:

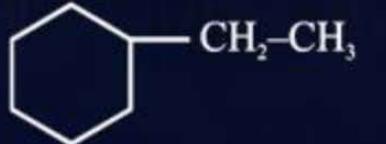


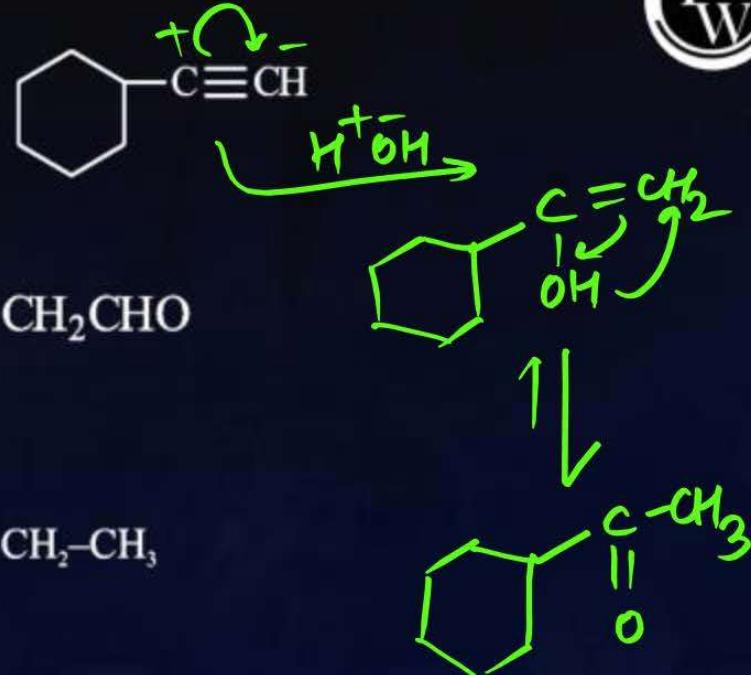
- A A is true but R is false.
- B A is false but R is true 
- C Both A and R are true and R is the correct explanation of A.
- D Both A and R are true but R is NOT the correct explanation of A.

QUESTION-12

The major product formed during the hydration of
in the presence of $\text{H}_2\text{SO}_4 / \text{HgSO}_4$ is:

- A 
- C 

- B 
- D 



QUESTION-13**Match List-I with List-II**

List-I (Reagents)		List-II (Process)	
(A)	H_2/Ni (III)	(I)	Ozonolysis
(B)	$R-X + AlCl_3$ (IV)	(II)	Dehalogenation
(C)	Zn (I)	(III)	Hydrogenation
(D)	(i) O_3 (I) (ii) Zn-H ₂ O	(IV)	Friedel-Crafts reaction

Choose the correct answer from the options given below:

- A** A-III, B-I, C-II, D-IV
- B** A-III, B-II, C-IV, D-I
- C** A-III, B-IV, C-II, D-I 
- D** A-II, B-III, C-IV, D-I

QUESTION-14



Ethene reacts with cold, dilute and aqueous solution of KMnO_4 to form:

- A Ethane-1, 2-diol
- B Ethanol
- C Ethanal
- D Ethanoic acid

QUESTION-15



Which of the following does not belong to alkanes homologous series?

A



B



C



D

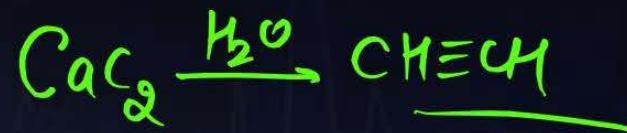


QUESTION-16



Calcium carbide when treated with water gives:

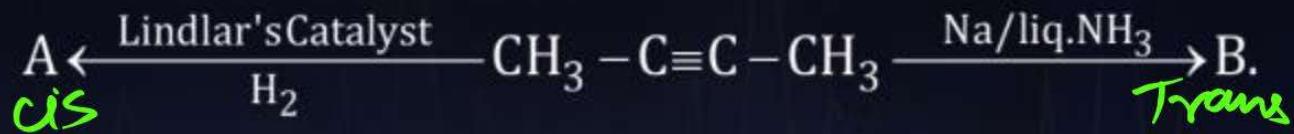
- A ethene
- B methane
- C ethyne ✓
- D ethane



QUESTION-17

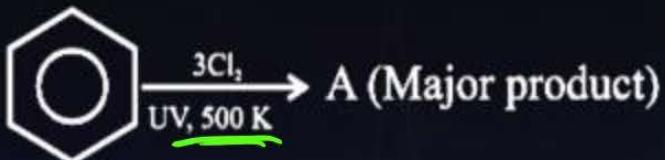


A and B respectively are;

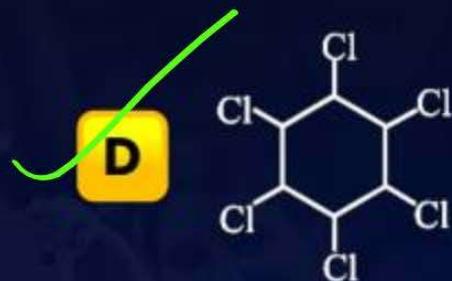
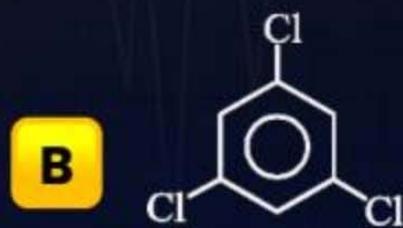
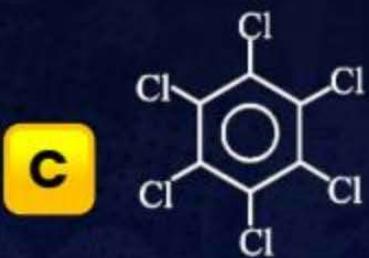
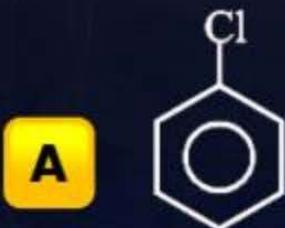


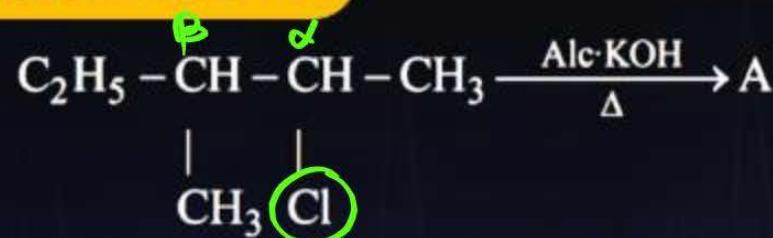
- A cis-But-2-ene and trans-But-2-ene
- B trans-But-2-ene and Butane
- C trans-But-2-ene and cis-But-2-ene
- D cis-But-2-ene and Butane

QUESTION-18

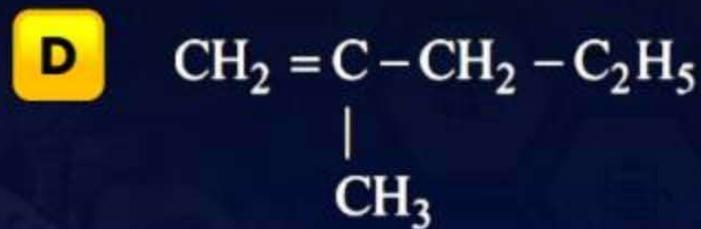
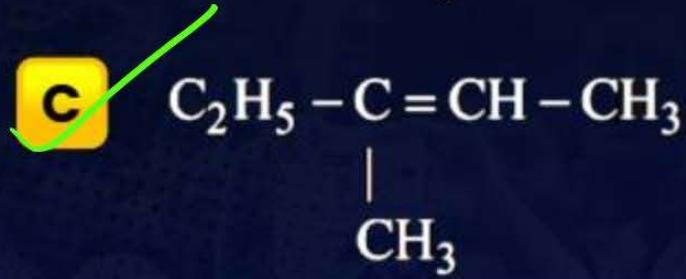
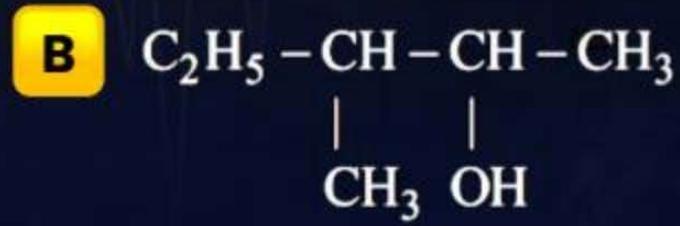
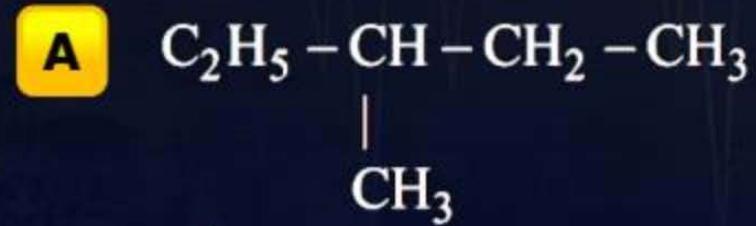


Product 'A' in the given reaction is:



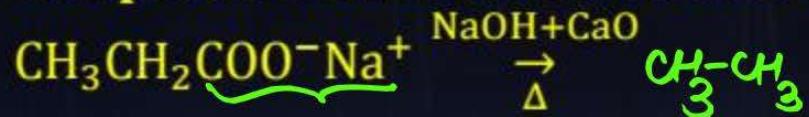
QUESTION-19

Major product 'A' is:



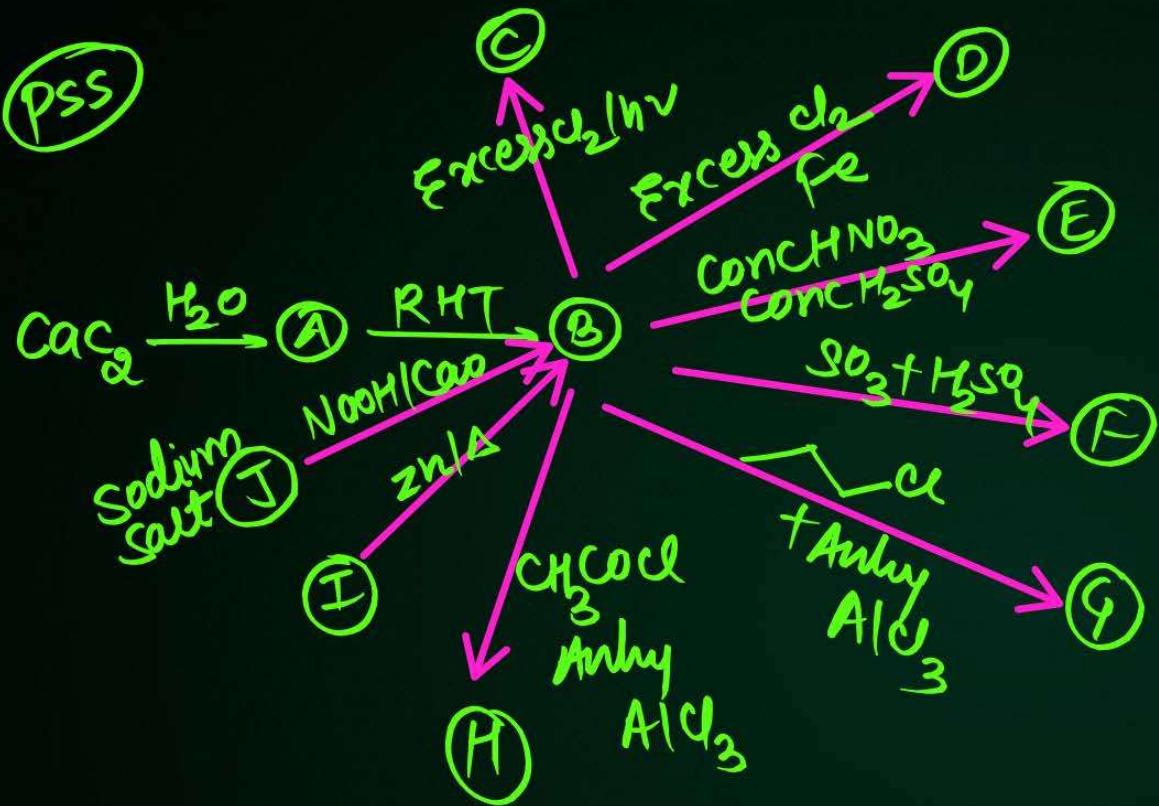
QUESTION-20

The product formed in the following reaction is:



- A** Hexane
- B** Propane
- C** Ethane
- D** Methane

PSS



H.W

[Comment the answers]

PW