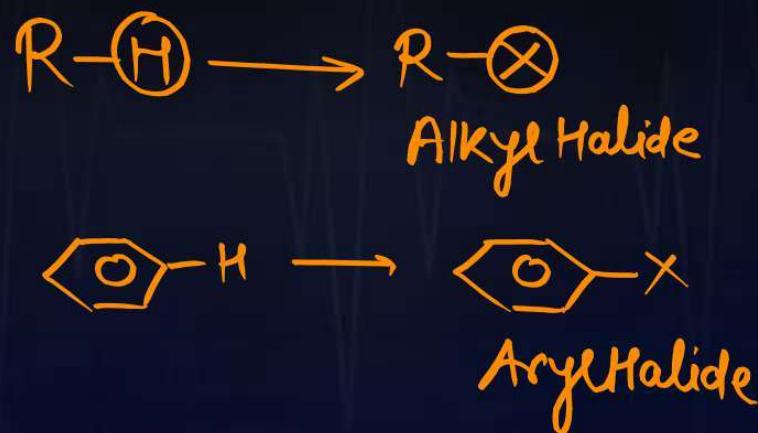
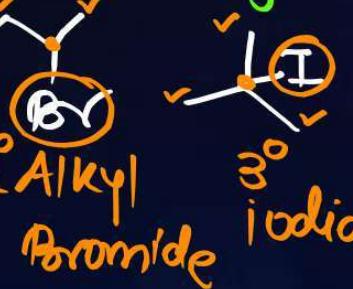
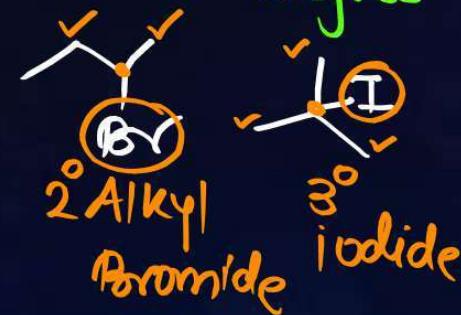




General Introduction



Degree = *x* jis 'c' se
juda hai uski
degree

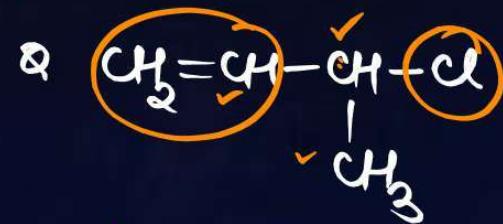
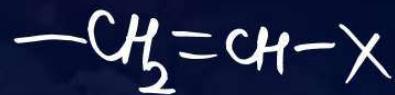
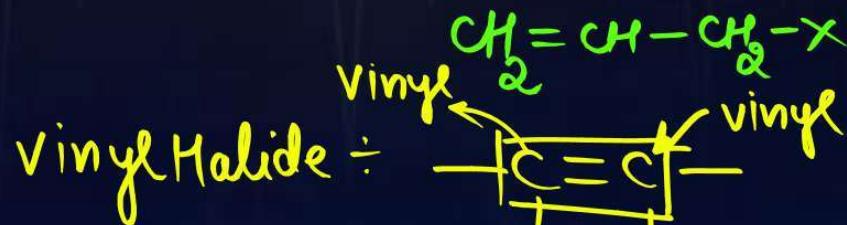




Classification of Haloalkanes & Haloarenes

Alkyl Halide $\div R-X$, Aryl Halide $\div Ph-X$

Allyl Halide \div

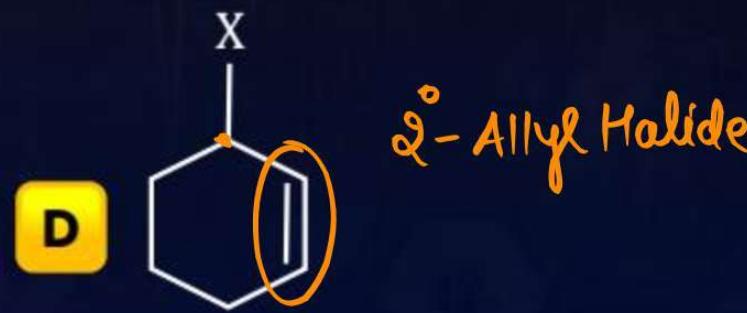
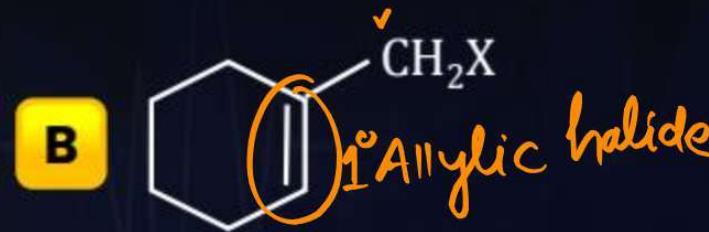


δ° - Allyl chloride

C.Q. 01 (JEE Mains 30th January 2024, Morning Shift)

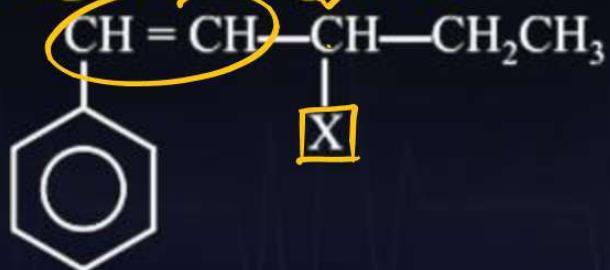


Example of vinylic halide is:



C.Q. 02 (NEET 2023)

The given compound



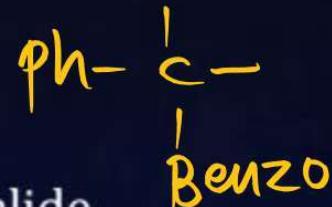
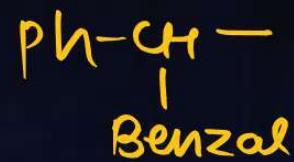
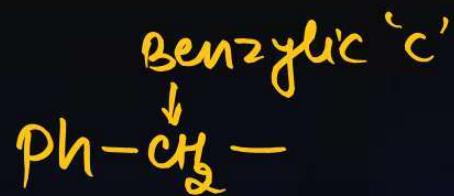
is an example of _____.

A Vinylic halide

C Aryl halide

B Benzylc halide

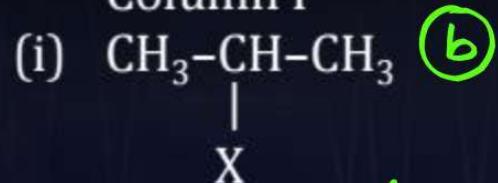
D Allylic halide



C.Q. 03 (NCERT Exemplar)

Match the structures of compounds given in Column I with the classes of compounds given in Column II.

Column I

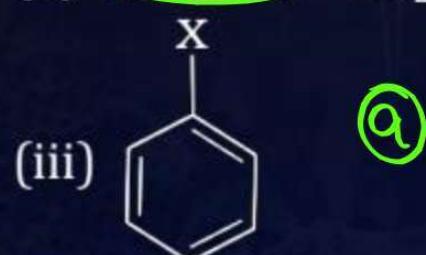


Column II

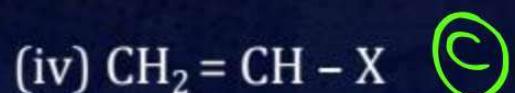
(a) Aryl halide



(b) Alkyl halide



(c) Vinyl halide



(d) Allyl halide



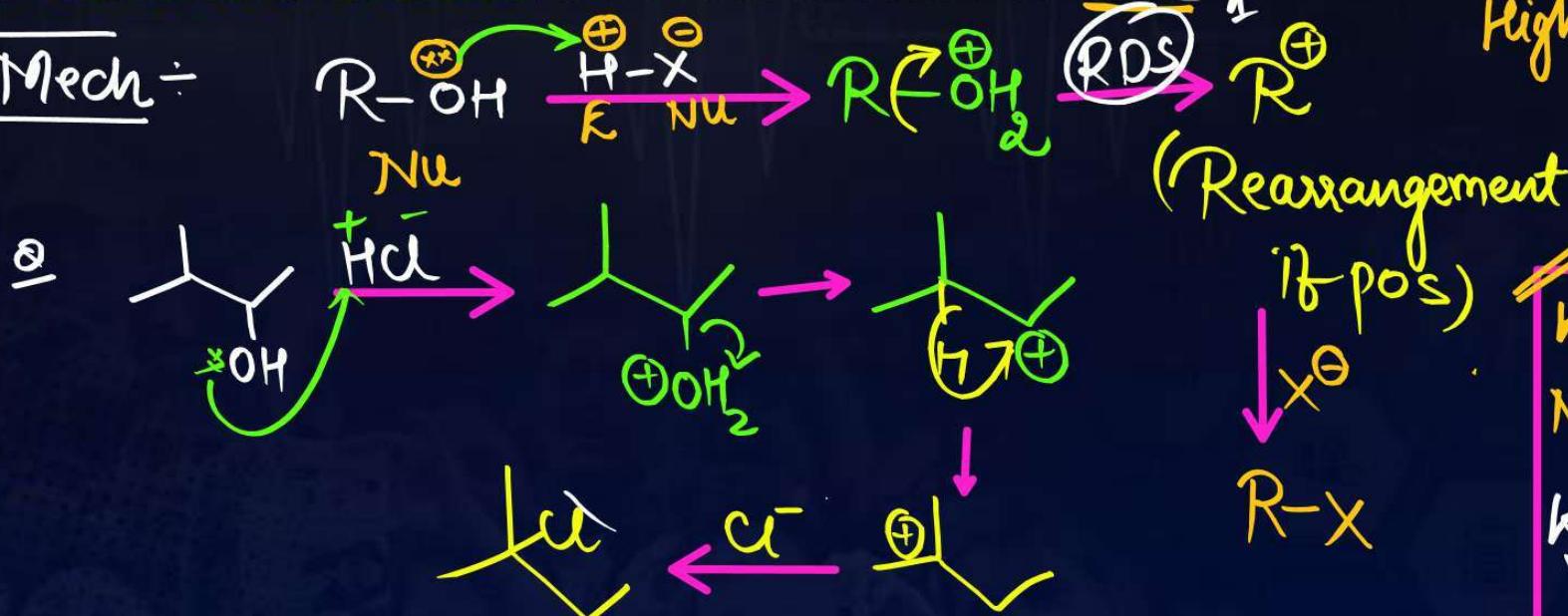
Methods of Preparation of Haloalkanes



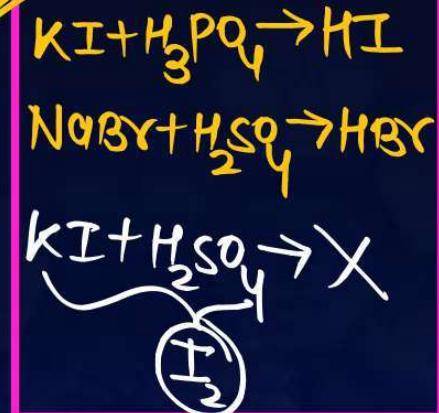
1. From Alcohols:

I. Reaction with HX/ZnCl_2

Mech :-



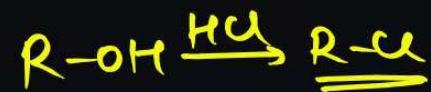
low e⁻ density
High e⁻ density



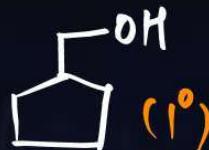
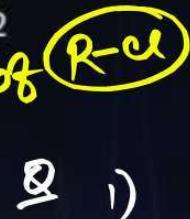
Lucas's Test: For Alcohols

P
W

Lucas reagent: Conc. HCl / Anhyd. ZnCl₂



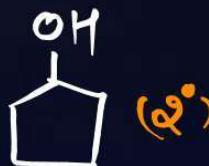
1° R-OH → No turbidity



turbidity
NO

2° R-OH → Min

2)



Min

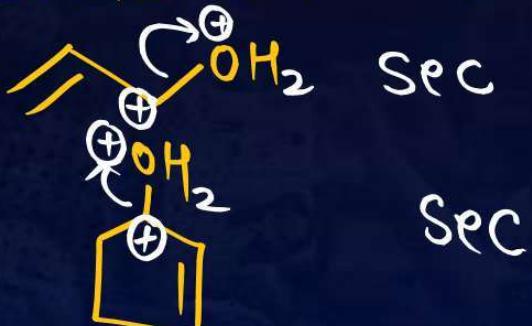
3° R-OH → Sec

3)



Sec

Reostab 1° & 2° → Sec

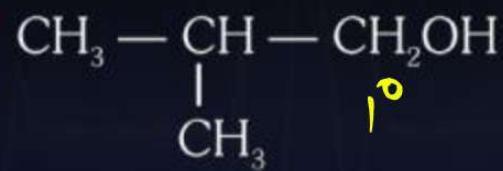


C.Q. 04 (NEET 2024)

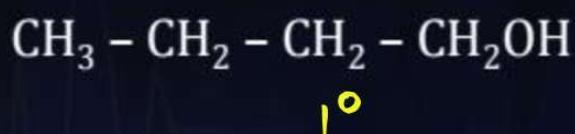


Which one of the following alcohols reacts instantaneously with Lucas's reagent?

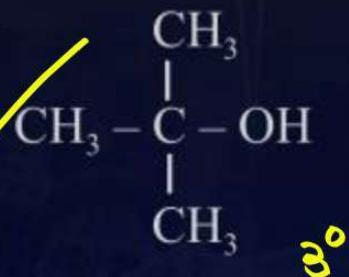
A



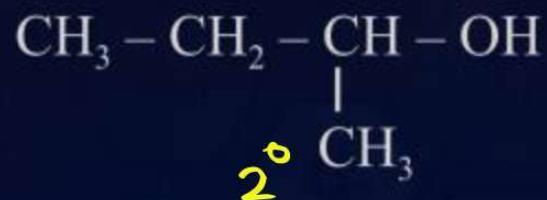
B



C

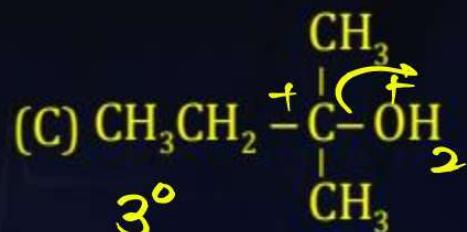
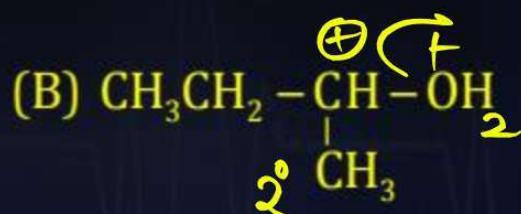
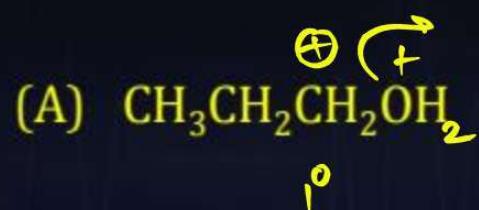


D



C.Q. 05 (NCERT Exemplar)

The order of reactivity of following alcohols with halogen acids is _____,



- A (A) > (B) > (C)
- C (B) > (A) > (C)

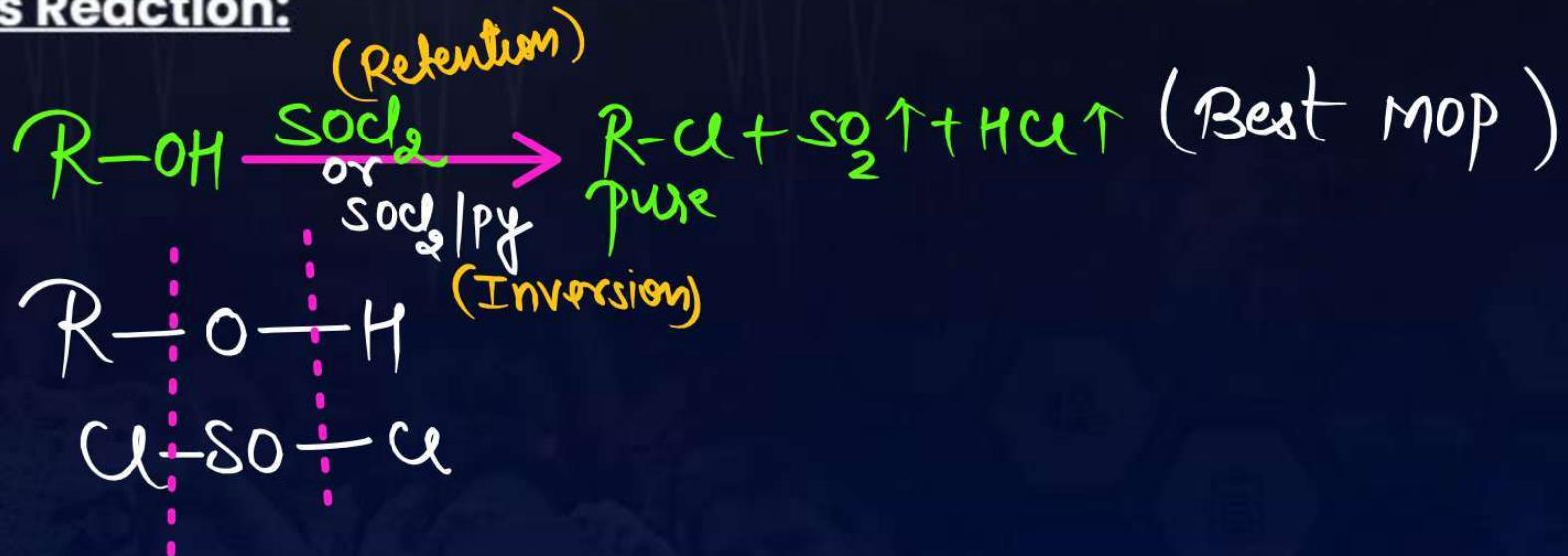
- B (C) > (B) > (A)
- D (A) > (C) > (B)



Methods of Preparation of Haloalkanes

II. From Alcohol without rearrangement:

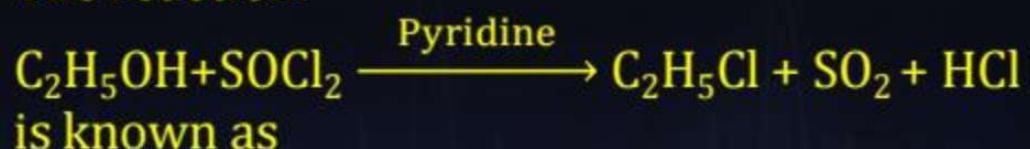
A. Darzen's Reaction:



C.Q. 06 (AIIMS 2002)

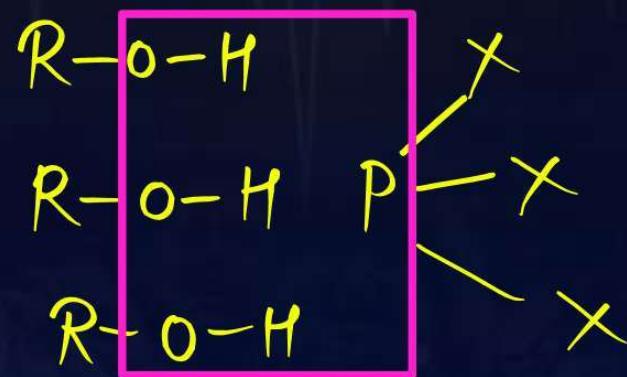
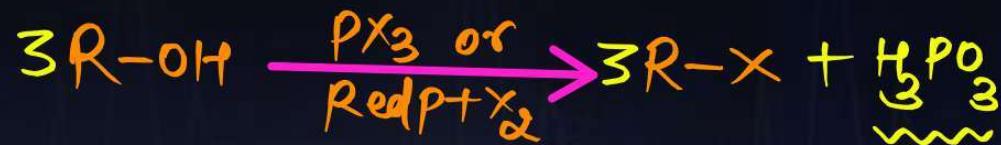


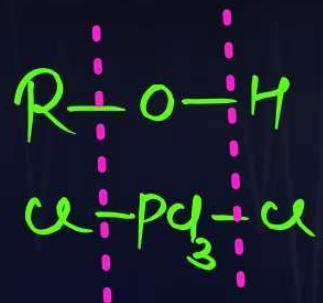
The reaction:



- A Kharasch effect
- B Williamson's synthesis
- C Darzen's procedure
- D None of these

B. Reaction with PX_3 and Red P/X_2 :



C. Reaction with PCl_5 :

C.Q. 07 (NCERT Exemplar)

Sod,

PW

Assertion: Phosphorus chlorides (tri and penta) are preferred over thionyl chloride for the preparation of alkyl chlorides from alcohols.

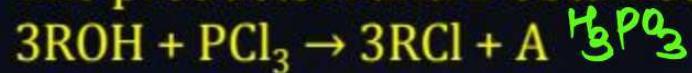
Reason: Phosphorus chlorides give pure alkyl halides.

- A** Assertion and reason both are correct and reason is correct explanation of assertion.
- B** Assertion and reason both are wrong statements.
- C** Assertion is correct but reason is wrong statements
- D** Assertion is wrong but reason is correct statement.

C.Q. 08 [NEET 2024]



The products A and B obtained in the following reactions respectively are:



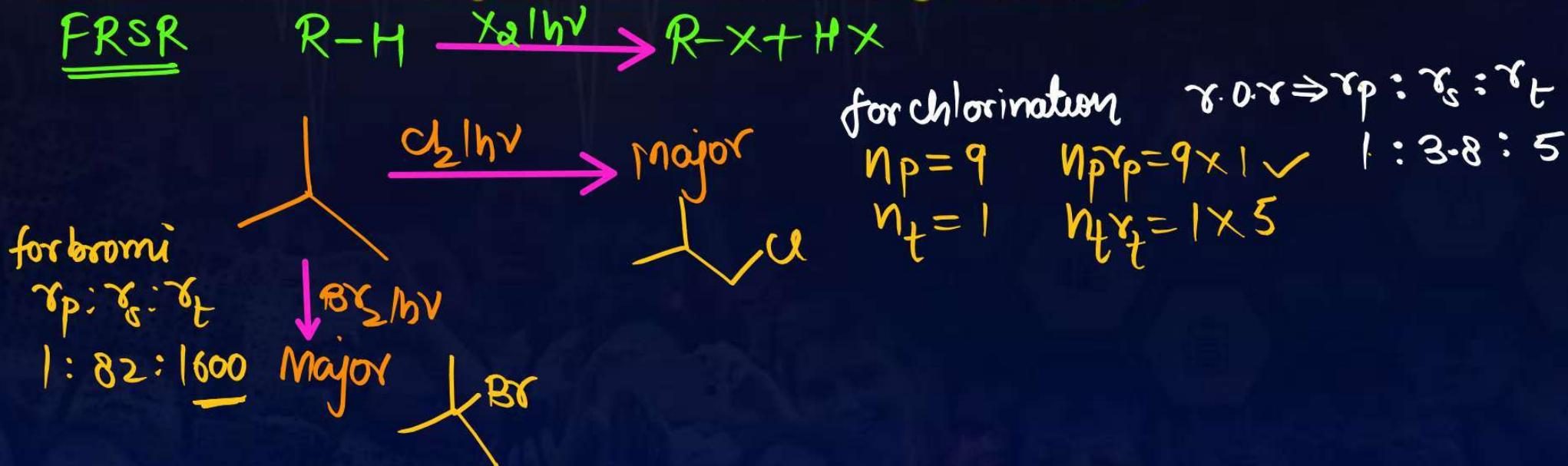
- A H_3PO_4 and POCl_3
- B** H_3PO_3 and POCl_3
- C POCl_3 and H_3PO_3
- D POCl_3 and H_3PO_4



Methods of Preparation of Haloalkanes

2. From Hydrocarbons:

A. From alkanes by free radical halogenation:

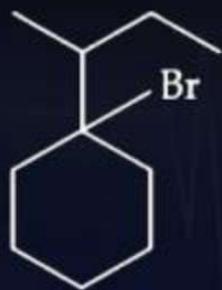


C.Q. 09 (JEE Mains 2025, 22 January Shift-2)

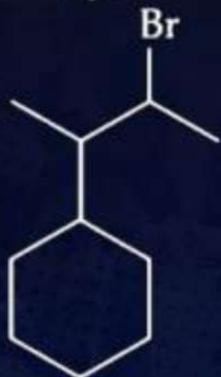


When sec-butylcyclohexane reacts with bromine in the presence of sunlight, the major product is:

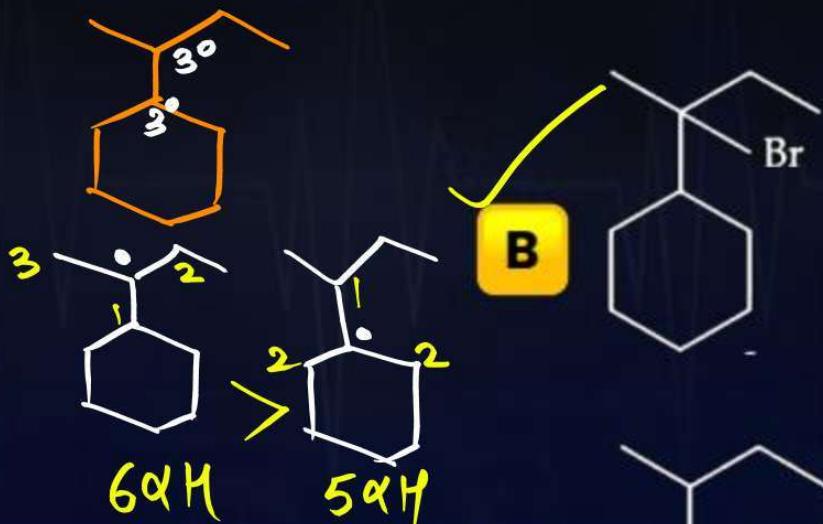
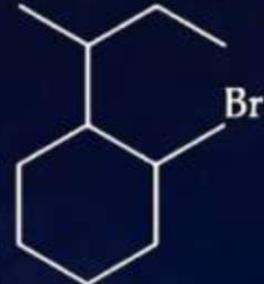
A



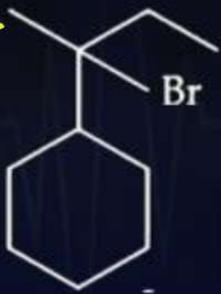
C



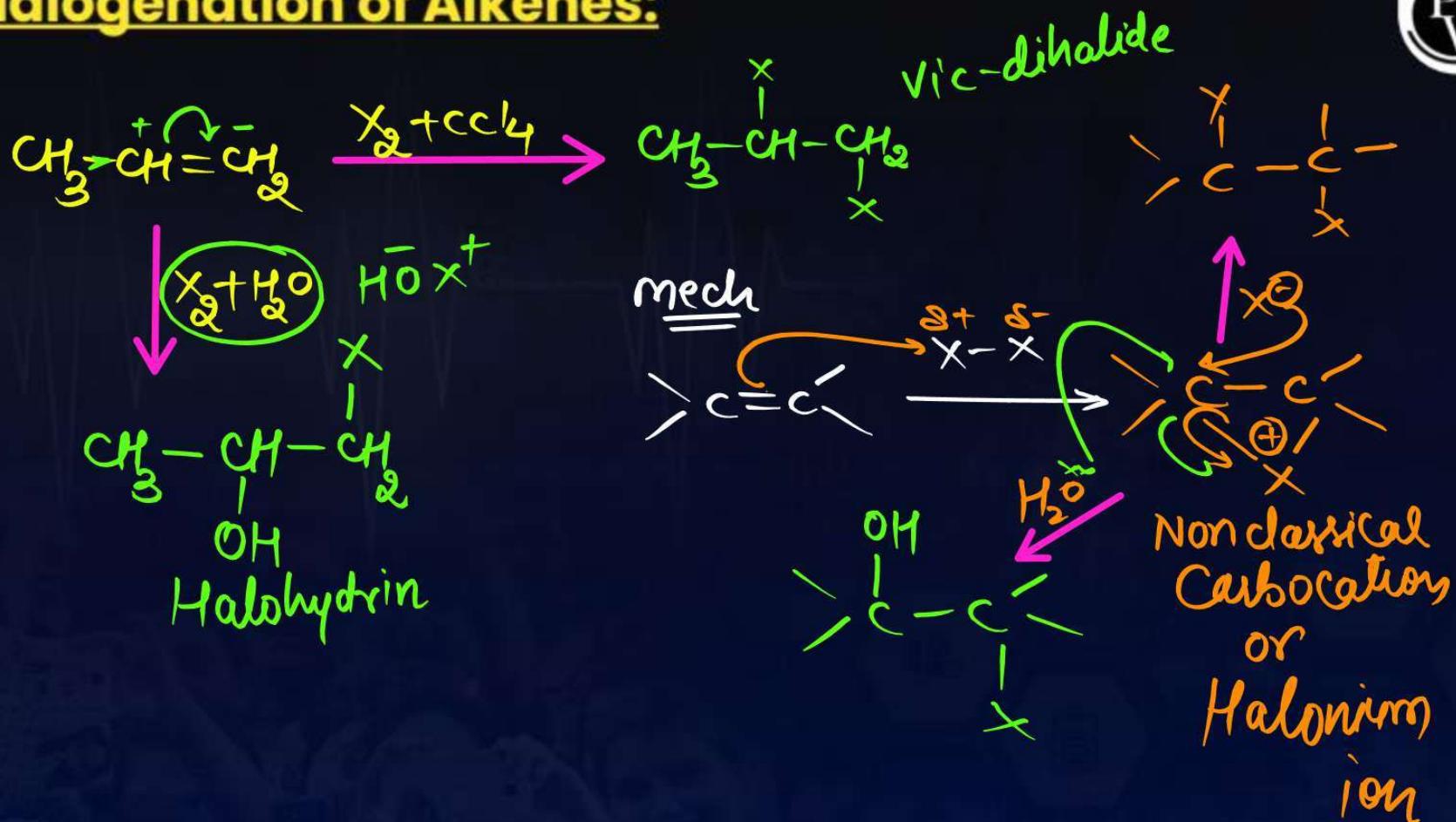
D



B

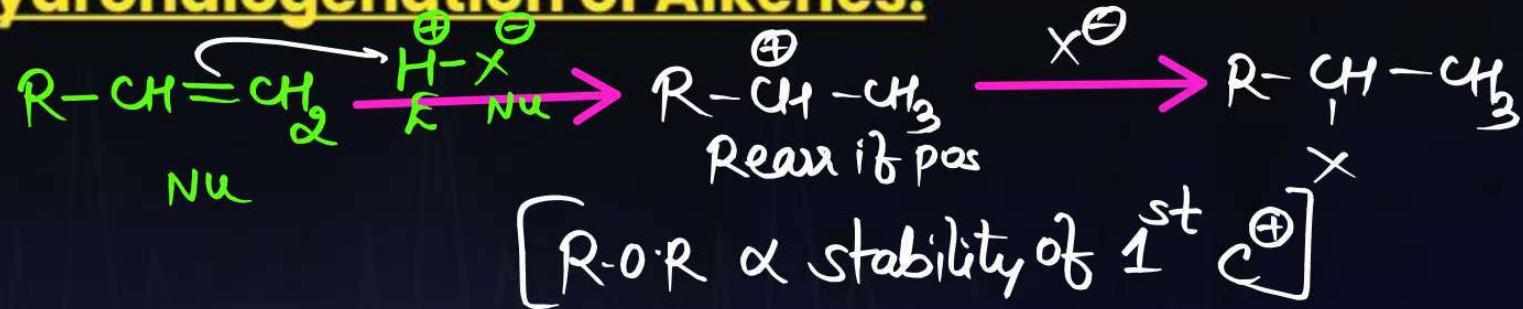


B. From Halogenation of Alkenes:



C. From Hydrohalogenation of Alkenes:

Mech:

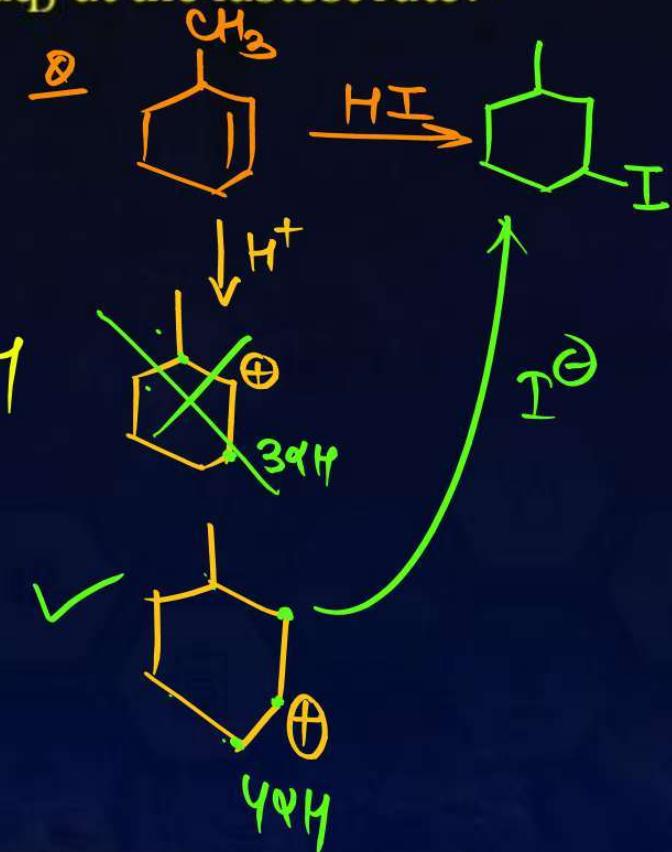
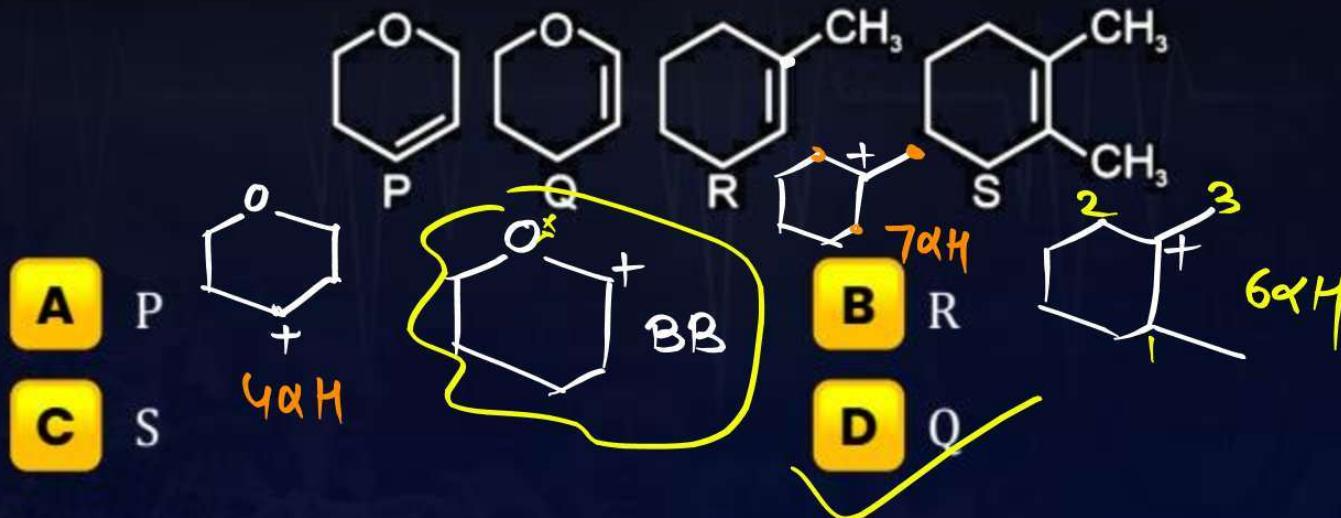


C.Q. 10 (JEE Mains 2025, 24 January Shift-1)



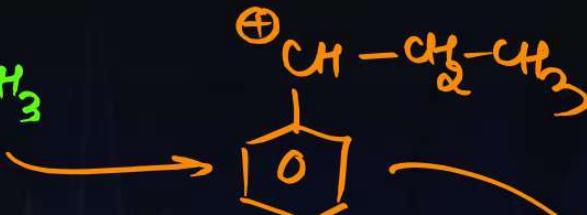
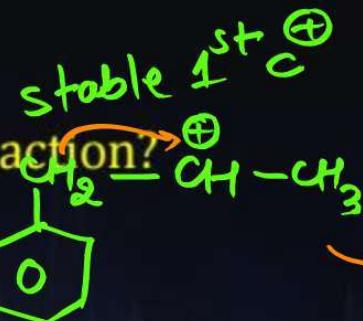
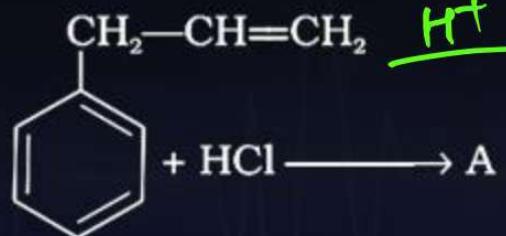
Following are the four molecules "P", "Q", "R" and "S".

Which one among the four molecules will react with HBr(aq) at the fastest rate?

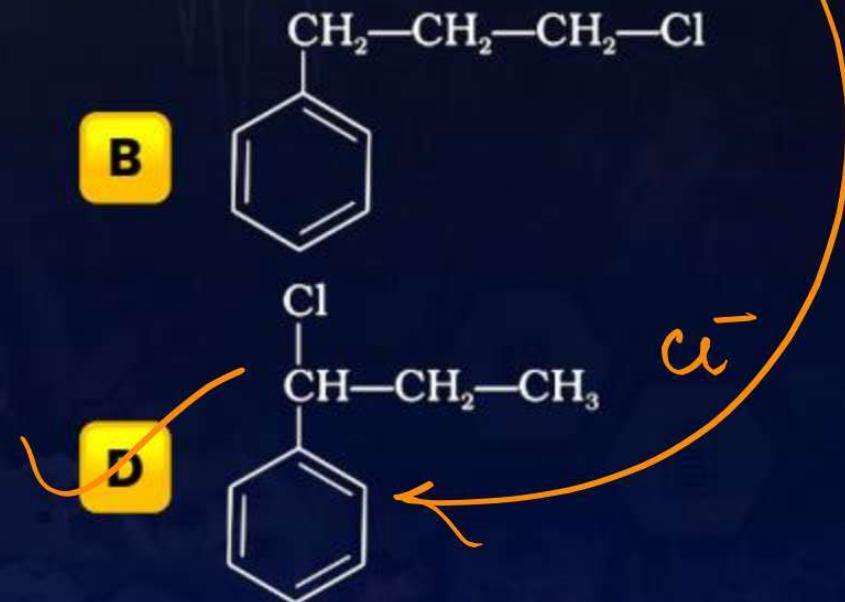


C.Q. 11 (NCERT Exemplar)

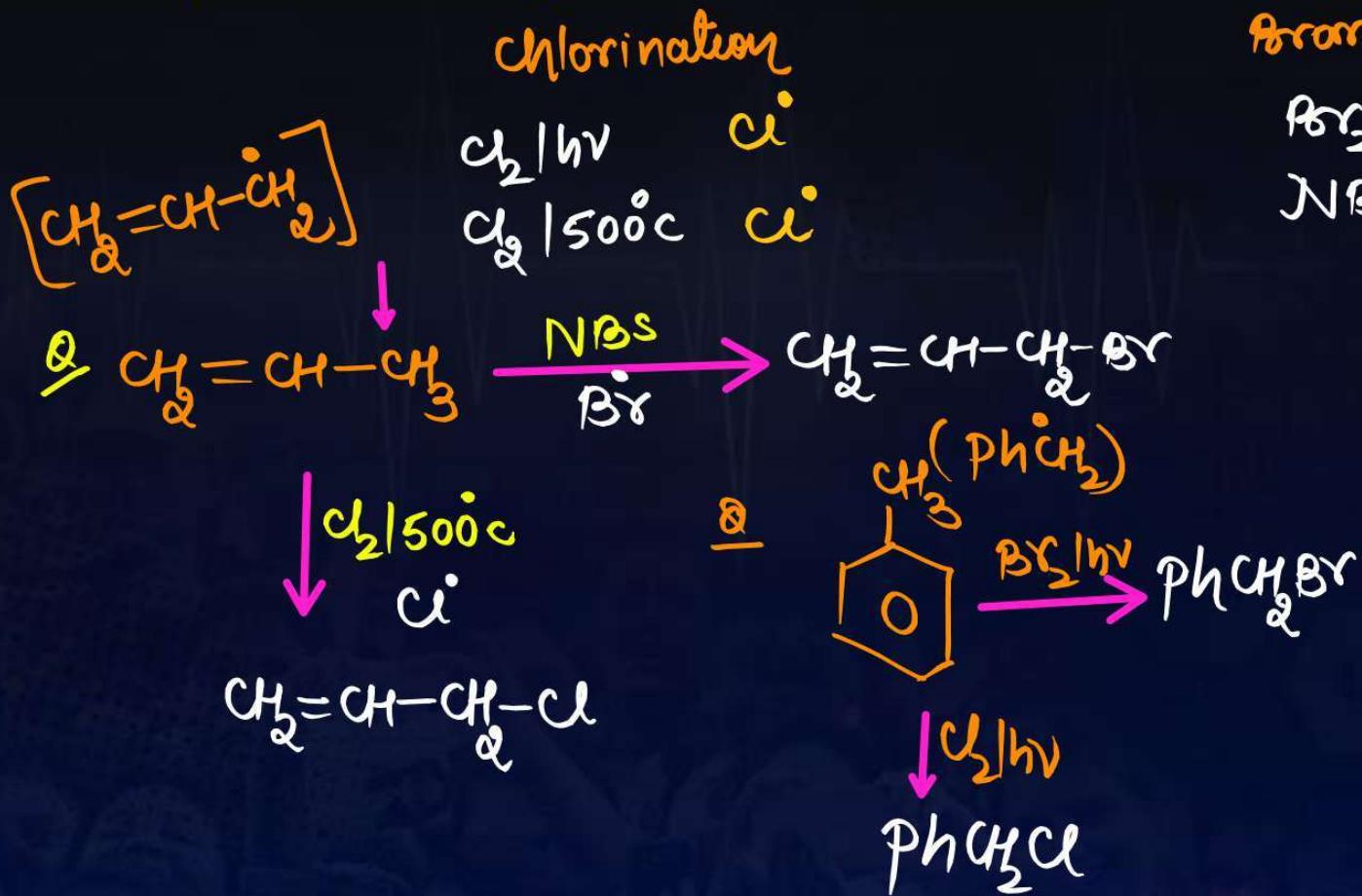
What is 'A' in the following reaction?



- A**
- B**
- C**



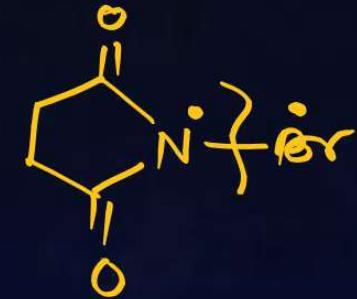
3. Allylic & Benzylic Substitution



bromination

$\text{Br}_2 | \text{hv}$ Br^\bullet

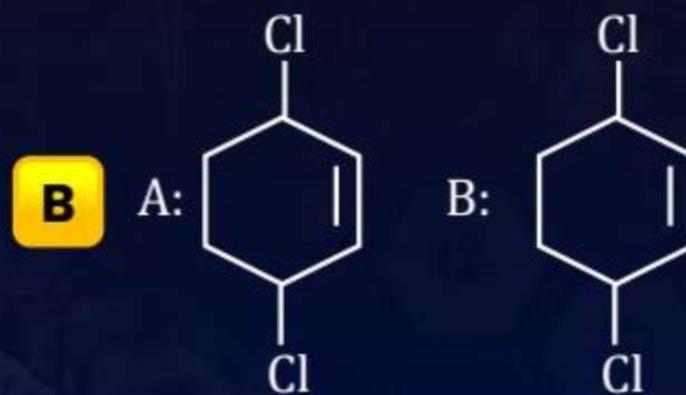
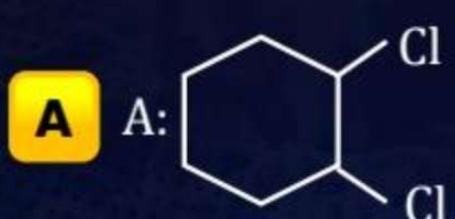
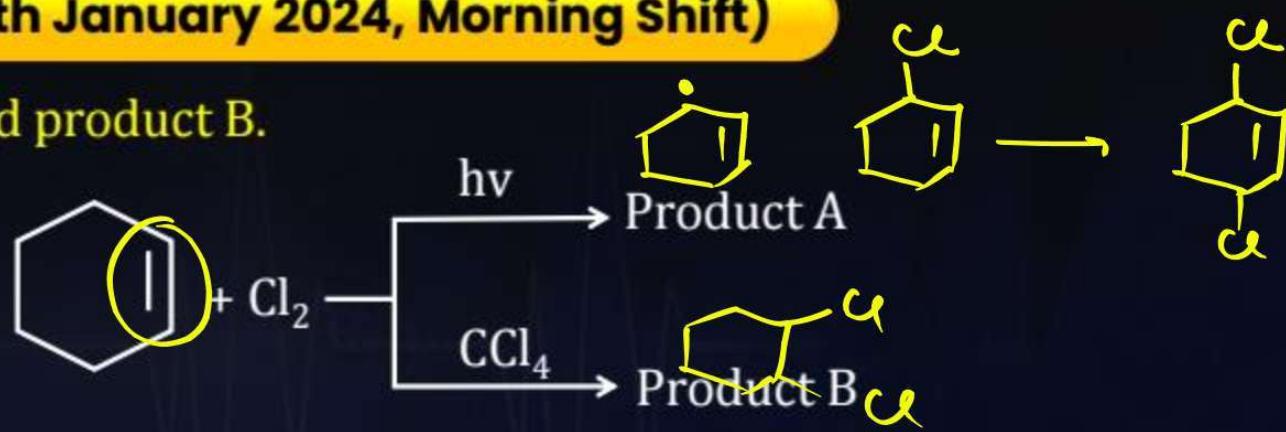
NBS (N -bromosuccinimide)



C.Q. 12 (JEE Mains 29th January 2024, Morning Shift)

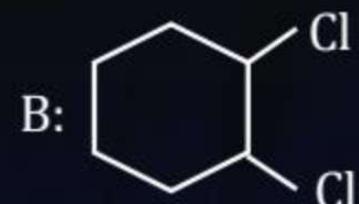
PW

Identify product A and product B.



C**D**

A:



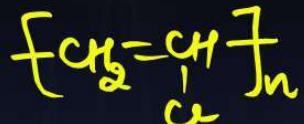
C.Q. 13



When chlorine is passed through propene at 500°C, which of the following is formed?

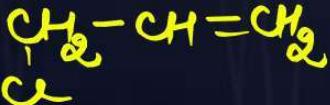
A

PVC



B

Allyl chloride



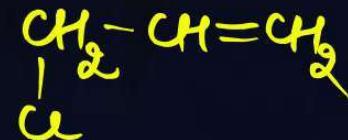
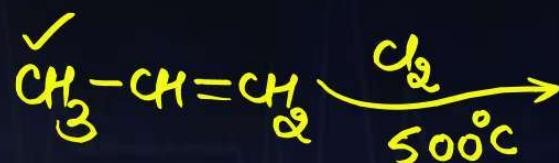
C

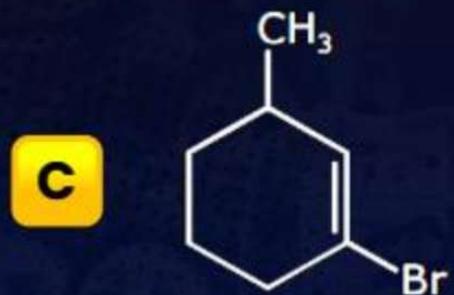
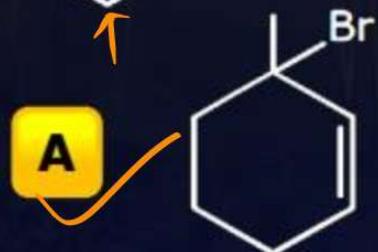
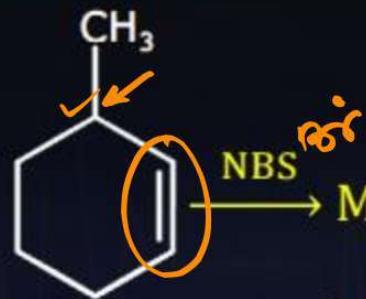
Nickel chloride



D

1, 2-dichloroethane



C.Q. 14

B



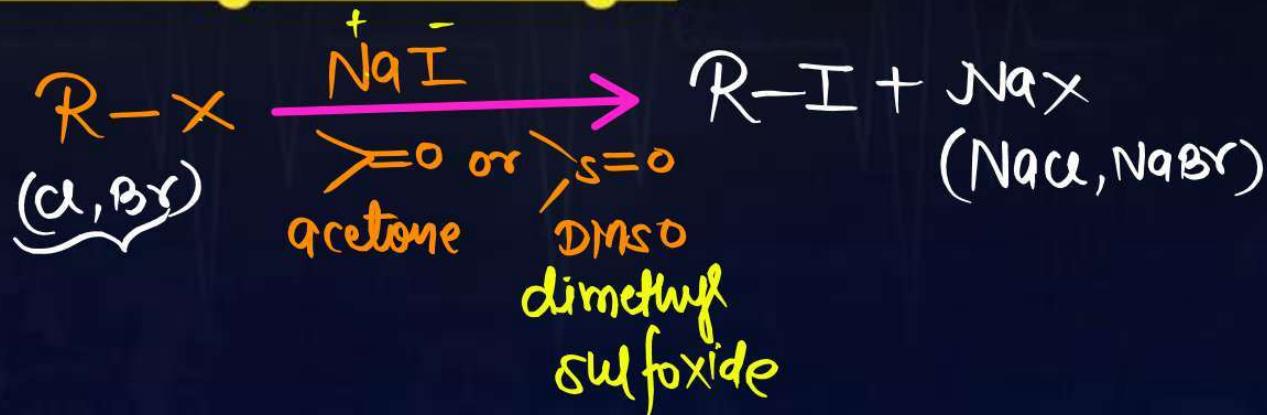
D

All of these



Methods of Preparation of Haloalkanes

4. From Halogen Exchange: A. Finkelstein reaction



C.Q. 15



Which of the following reagent is used in Finkelstein reaction?

- A NaI in dry acetone
- B CCl_4
- C $\text{HCl}, \text{ZnCl}_2$
- D HBr

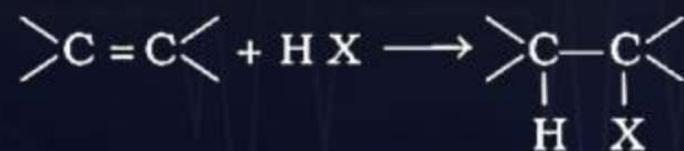
C.Q. 16 (NCERT Exemplar)

Which of the following is halogen exchange reaction?

A



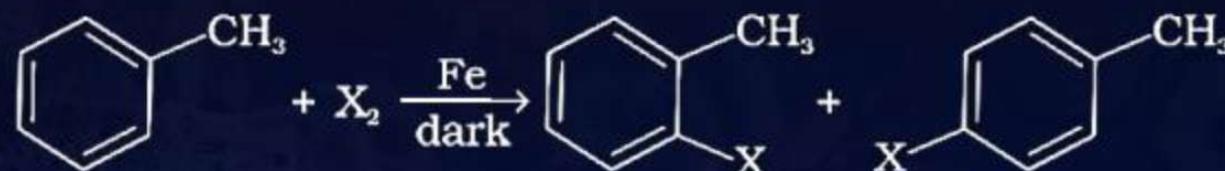
B

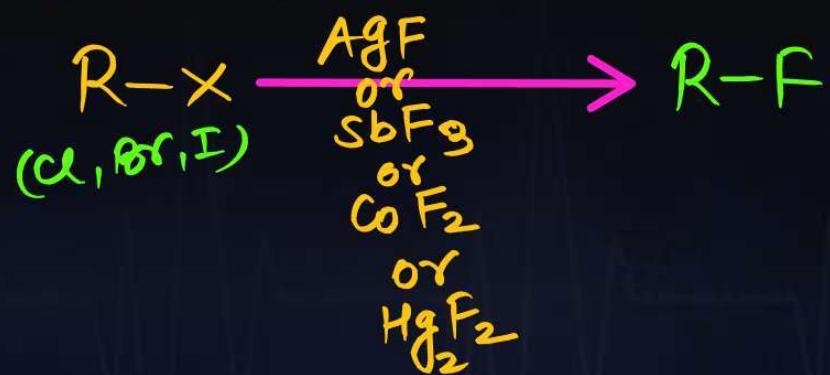


C



D



B. Swarts reaction

C.Q. 17 (AIIMS 2017)



The synthesis of alkyl fluorides is best accomplished by:

- A** Finkelstein reaction
- B** Swarts reaction
- C** Free radical fluorination
- D** Sandmeyer's reaction



C.Q. 18 (NCERT Exemplar)

Alkyl fluorides are synthesized by heating an alkyl chloride/bromide in presence of _____ or _____.

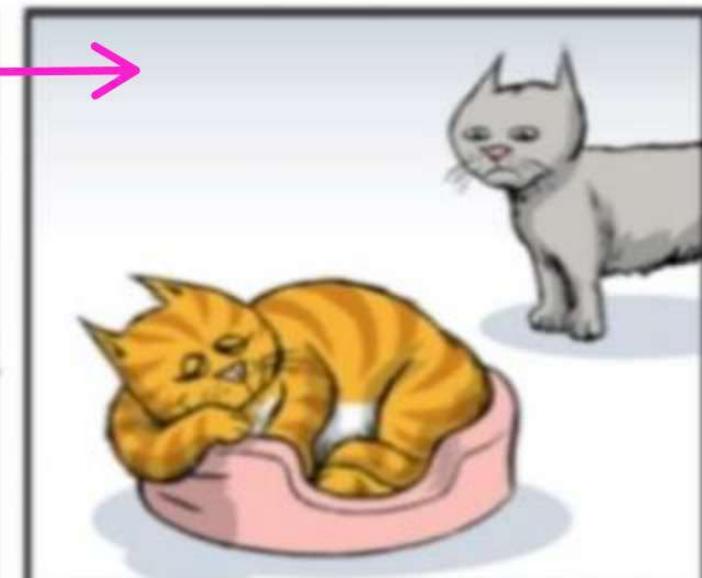
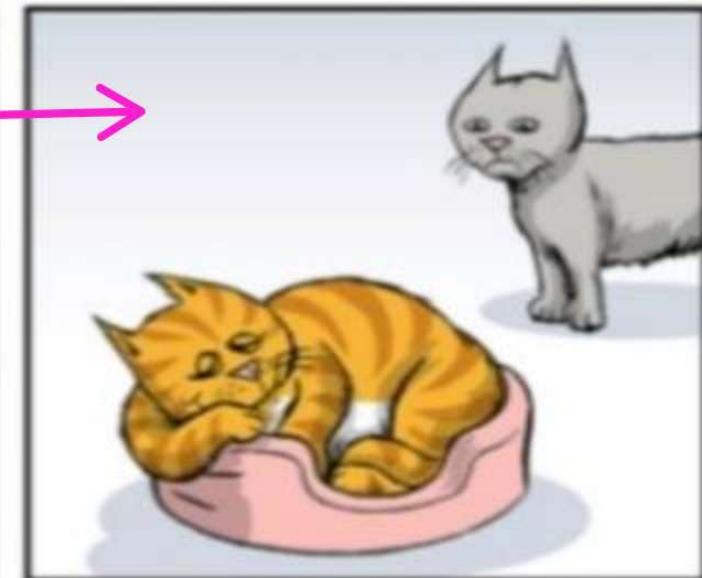
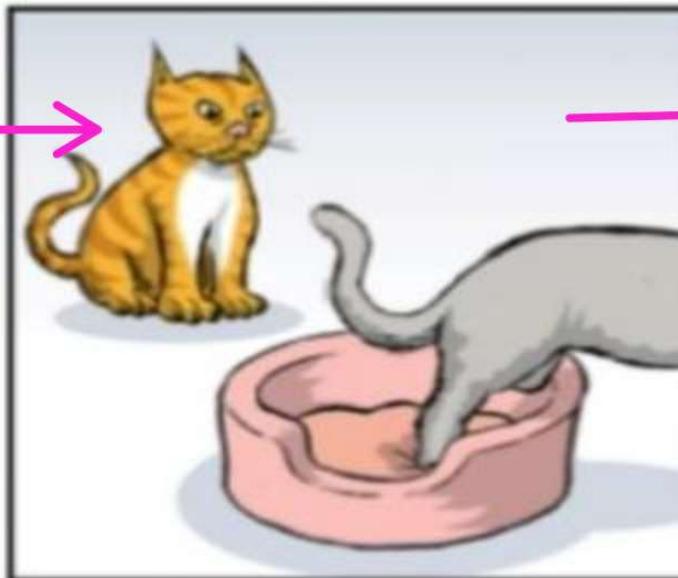
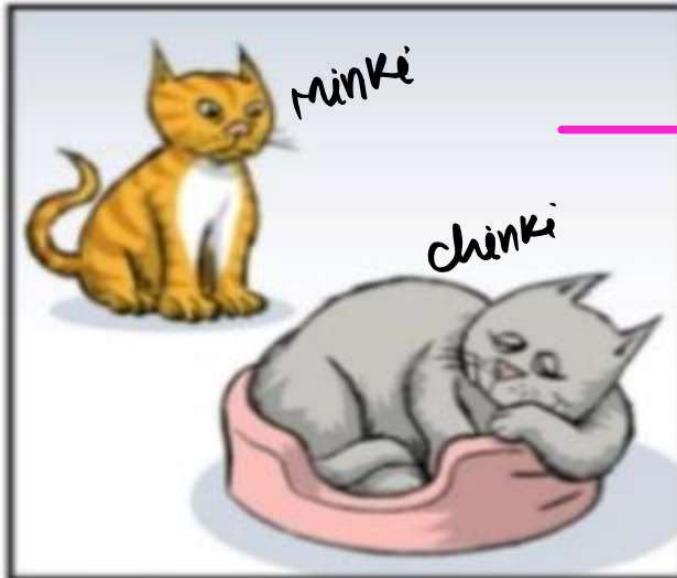
- A** CaF_2 ✗
- B** CoF_2 ✓
- C** Hg_2F_2 ↘
- D** Both (B) & (C)



Chemical Properties of Haloalkanes

1. Nucleophilic Substitution Reactions:





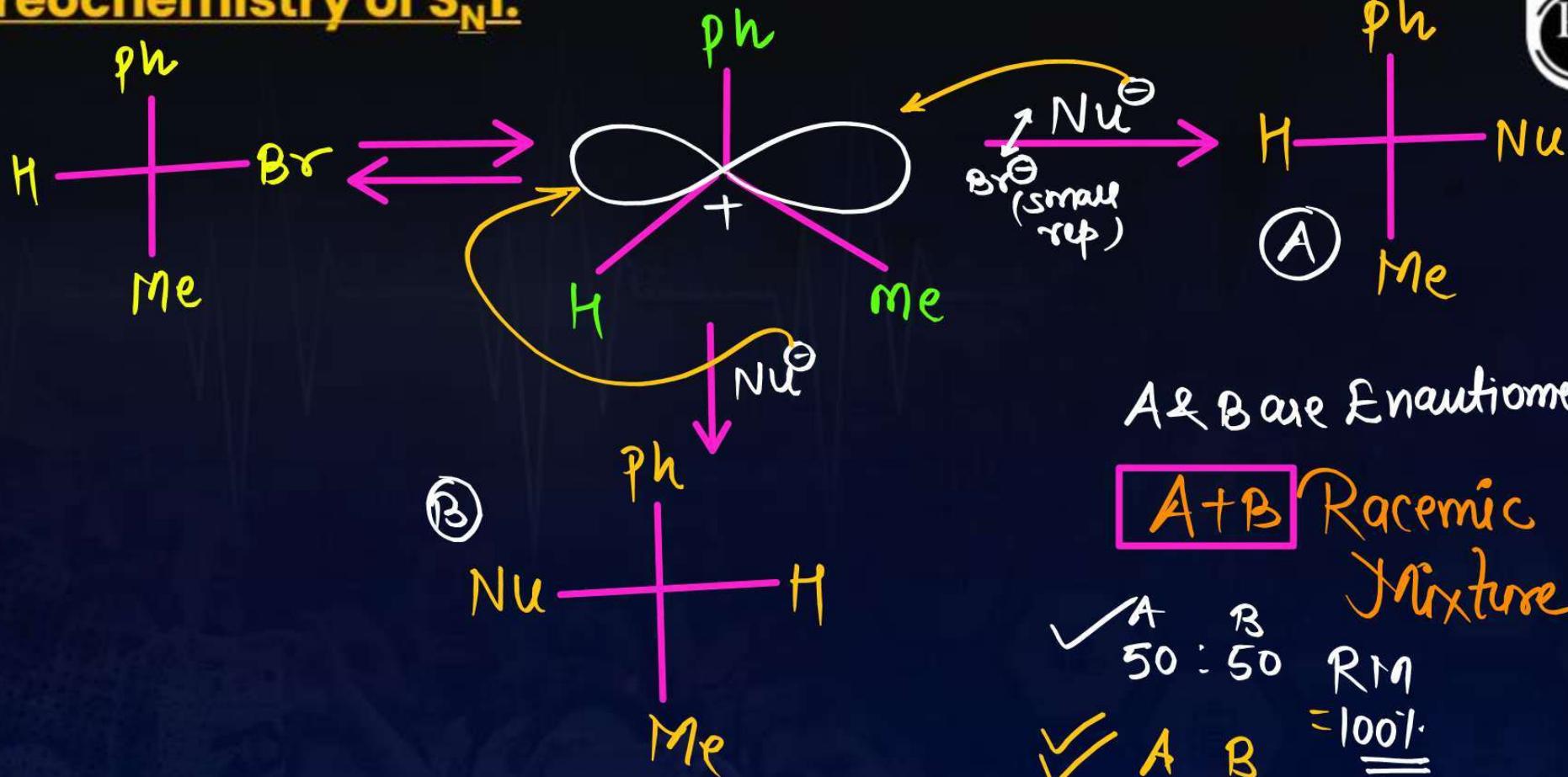
A. Unimolecular Nucleophilic Substitution Reaction S_N1 :



OP Points of S_N1:

1. Carbocation intermediate formation ✓ (Rearrange if pos)
2. 1st step is the R.D.S (slow step) B.E ↓ leaving ability ↑
3. R.O.R w.r.t. Halogen $R - \text{F} < R - \text{Cl} < R - \text{Br} < R - \text{I}$
R.O.R w.r.t. Alkyl ROR \propto Stability of 1st carbocation
4. Rate r = k[R-X]¹
5. Order = 1 & Molecularity = 1
6. PPS (Polar Protic Solvent)
7. Weak nucleophile
8. Racemization occurs retention & inversion
Retention < Inversion
49% 51%

Stereochemistry of S_N1:



A & B are Enantiomers

A + B Racemic Mixture

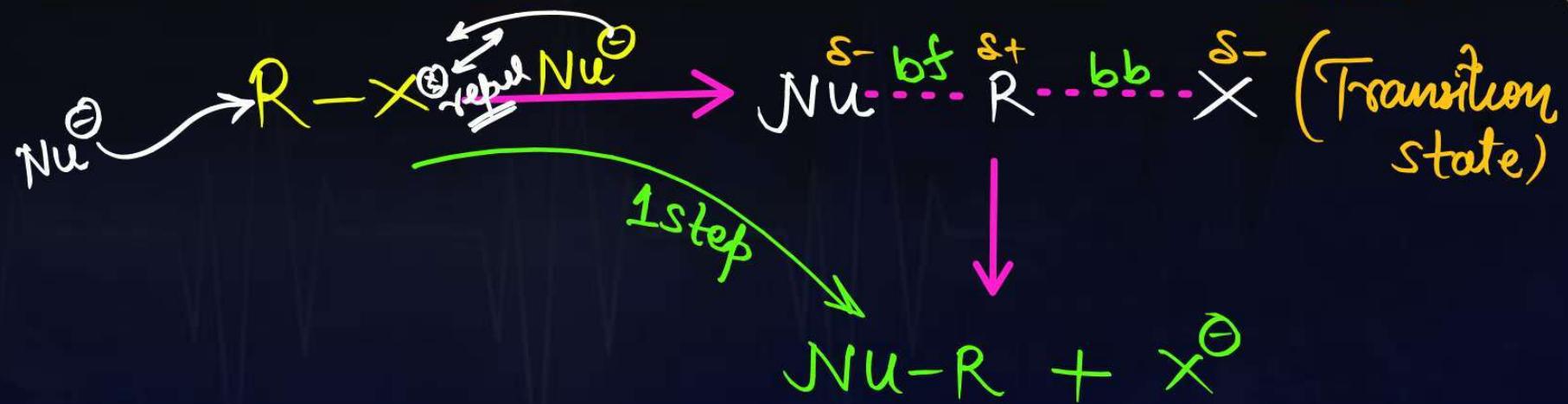
✓ A : B 50 : 50 RM

✓ A B = 100

49 : 51 RM + 100
Ret < inv



B. Bimolecular Nucleophilic Substitution Reaction S_N2 :



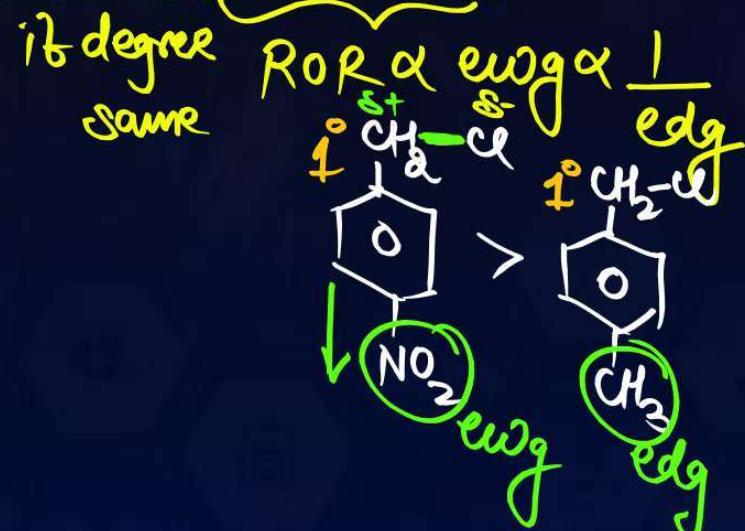
OP Points of S_N2:

1. Transition state formation ✓
2. 1st step is the R.D.S (slow step) ✓
3. R.O.R w.r.t. Halogen $R - F < R - Cl < R - Br < R - I$

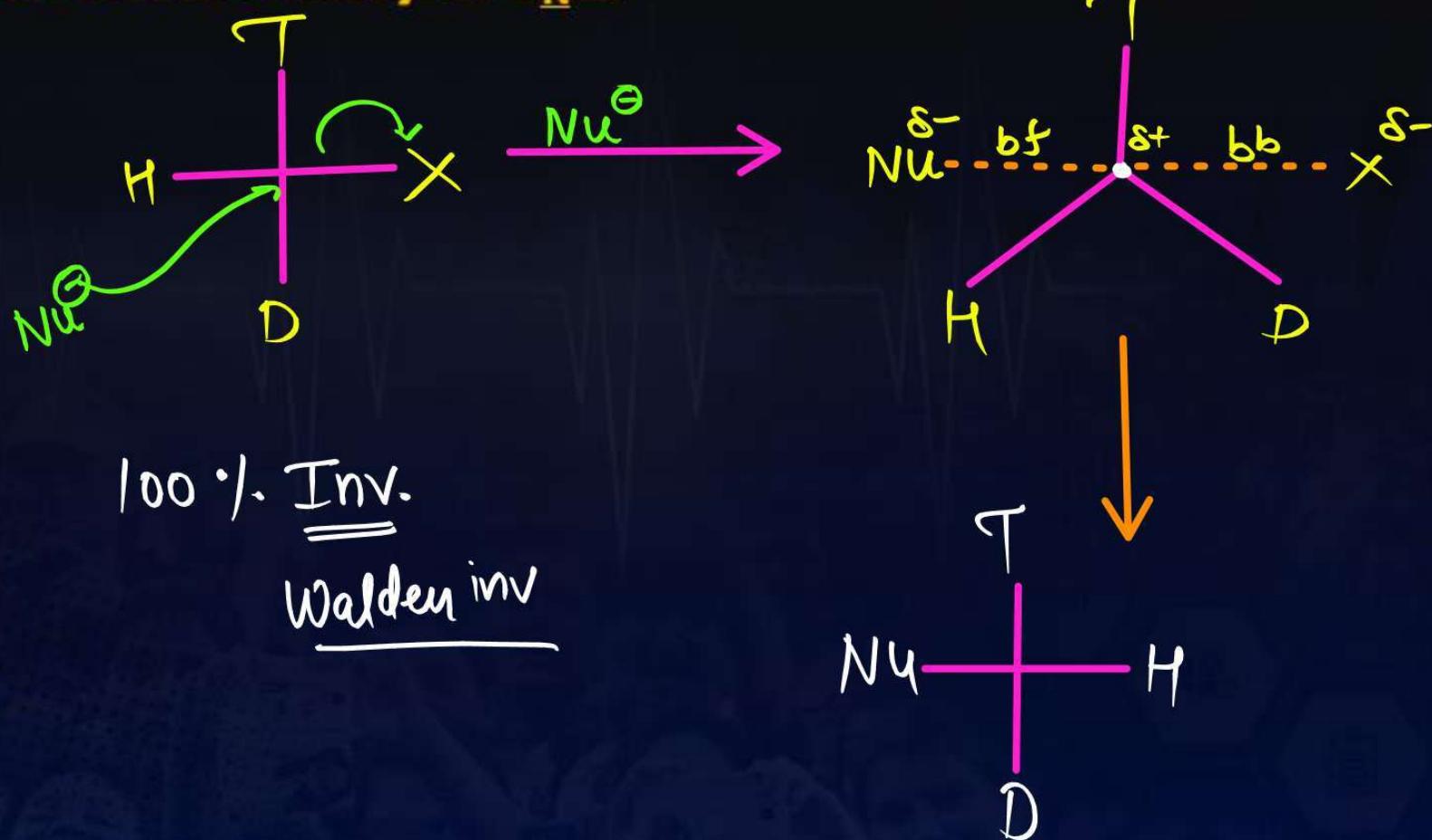
[BE ↓ leaving ability ↑]

4. Rate $r = k[R-X]^1 [Nu^-]^1$
5. Order = 2 & Molecularity = 2
6. PAS (Polar Aprotic Solvent)
7. Strong nucleophile
8. Inversion (Walden Inversion) (100%)

R.O.R w.r.t. Alkyl $ROR \propto \frac{1}{S.H}$ (S.H = Steric Hindrance) ($1^\circ > 2^\circ > 3^\circ$)



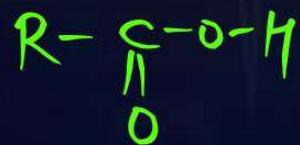
Stereochemistry of S_N2:



Effect of Solvent:

$\text{DM} \neq 0$
 \uparrow
 PPS (polar protic solvent)

ose H juda ho



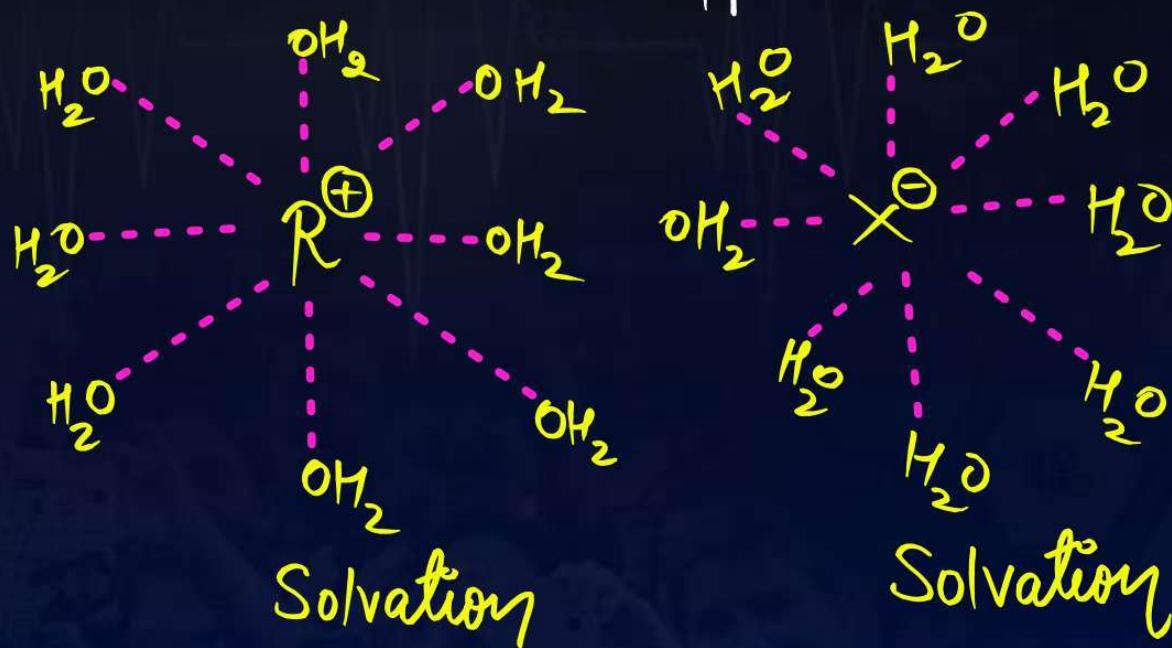
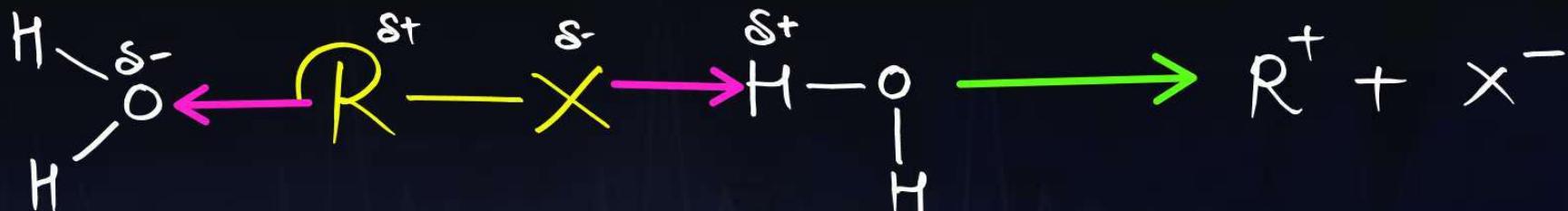
$\curvearrowleft \text{DM} \neq 0$
 PAS (polar aprotic solvent)
 o se H nahi juda ho
 $\succ \text{O}$ acetone

$\succ \text{S}=\text{O}$ DMSO
 (dimethyl sulfoxide)

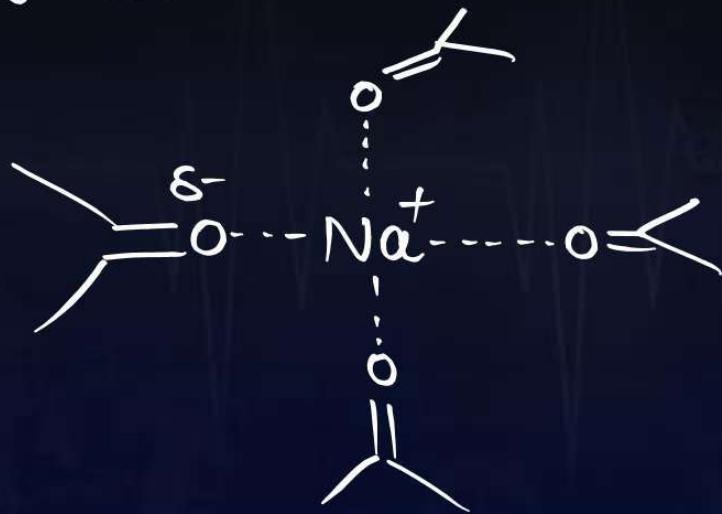
$\begin{matrix} \text{H} \\ | \\ \text{me}-\text{N}'-\text{C}=\text{O} \\ | \\ \text{me} \end{matrix}$ dimethyl formamide
 (DMF)

$\text{R}-\text{O}-\text{R}$ Ether

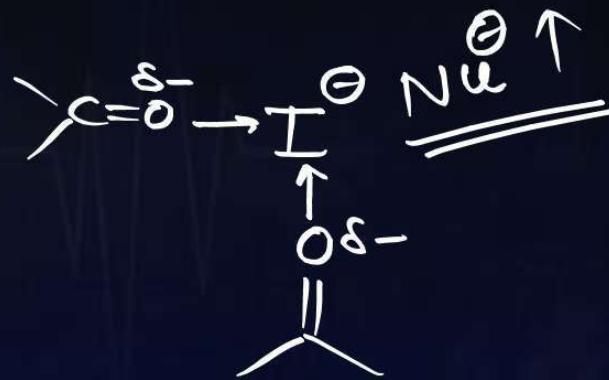
PPS favours S_N1 Reactions:



PAS favours S_N2 Reactions:

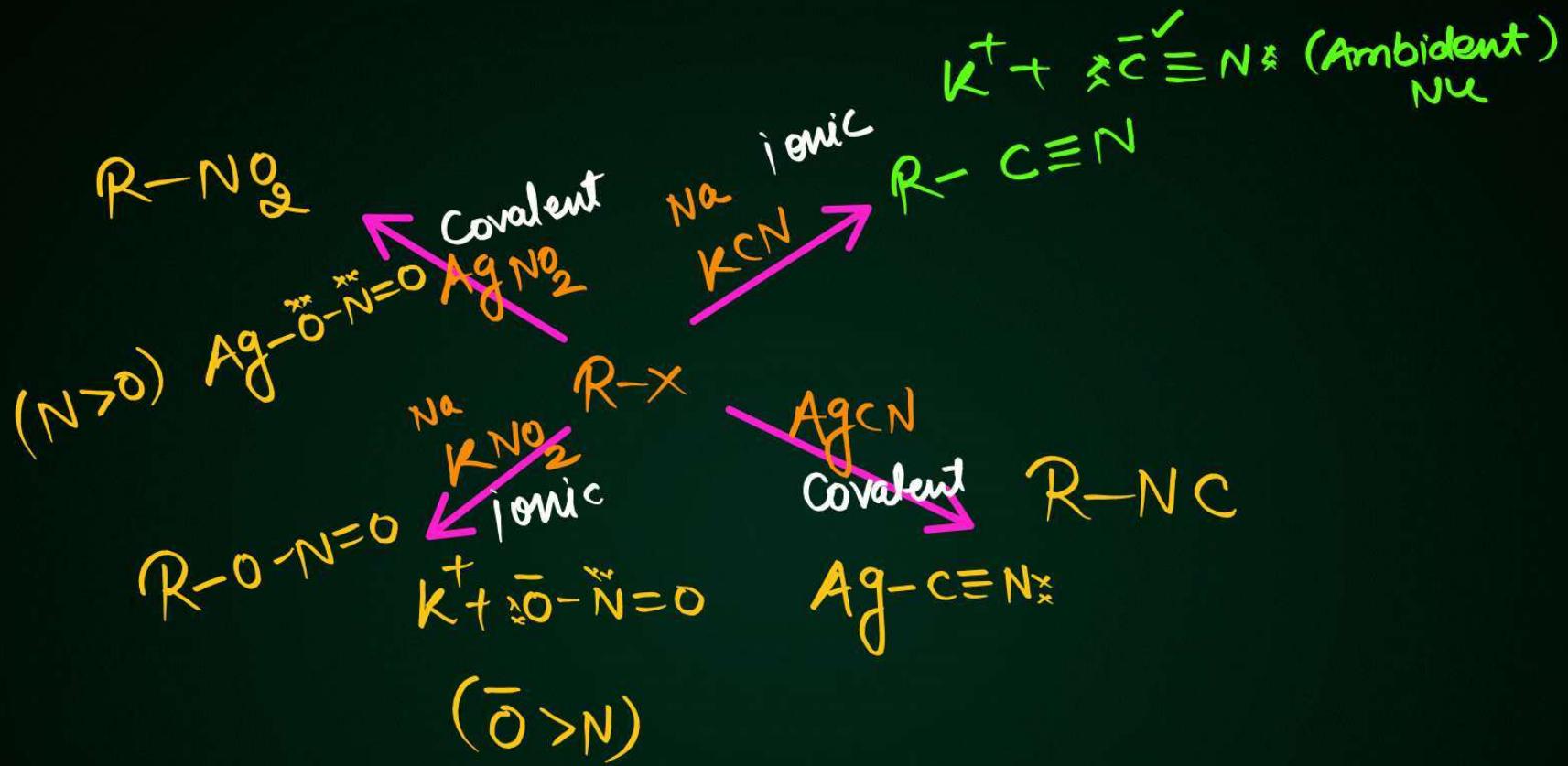


Solvation



Reagent	Nucleophile (Nu ⁻)	Substitution product R-Nu	Class of main product
SN^2 NaOH (KOH)	HO ⁻	ROH	Alcohol
SN^1 H ₂ O / ROH	H ₂ O	ROH	Alcohol
SN^2 NaOR'	R'O ⁻	ROR'	Ether
SN^2 NaI	I ⁻	R-I	Alkyl iodide
SN^2 NH ₃	NH ₃	RNH ₂	Primary amine
SN^2 R'NH ₂	R'NH ₂	RNHR'	Sec. amine
SN^2 R'R''NH	R'R''NH	RNR'R''	Tert. amine
SN^2 KCN *	C≡N:	RCN	Nitrile (cyanide)
SN^2 AgCN *	Ag-CN:	RNC (isocyanide)	Isonitrile
SN^2 KNO ₂ *	O=N—O	R—O—N=O	Alkyl nitrite
SN^2 AgNO ₂ *	Ag—O—N=O	R—NO ₂	Nitroalkane
SN^2 R'COOAg	R'COO ⁻	R'COOR	Ester
SN^2 LiAlH ₄	H	RH	Hydrocarbon
SN^2 R ⁺ M ⁻	R ⁺	RR'	Alkane

SN^2 NaOH (KOH)
 SN^1 H₂O / ROH Solvolysis
 SN^2 NaOR' Solvent He Nu hai
 SN^2 NaI
 SN^2 NH₃
 SN^2 R'NH₂
 SN^2 R'R''NH
 SN^2 KCN *
 SN^2 AgCN *
 SN^2 KNO₂ *
 SN^2 AgNO₂ *
 SN^2 R'COOAg
 SN^2 LiAlH₄
 SN^2 R⁺ M⁻



C.Q. 19 (JEE Mains 2025, 22 January Shift-1)



Given below are two statements:

Statement I: $\text{CH}_3\text{-O-CH}_2\text{-Cl}$ will undergo S_N1 reaction though it is a primary halide.



Statement II: $\text{CH}_3\text{-C(CH}_3\text{)}\text{-CH}_2\text{-Cl}$ will not undergo S_N2 reaction very easily though it is a

primary halide.

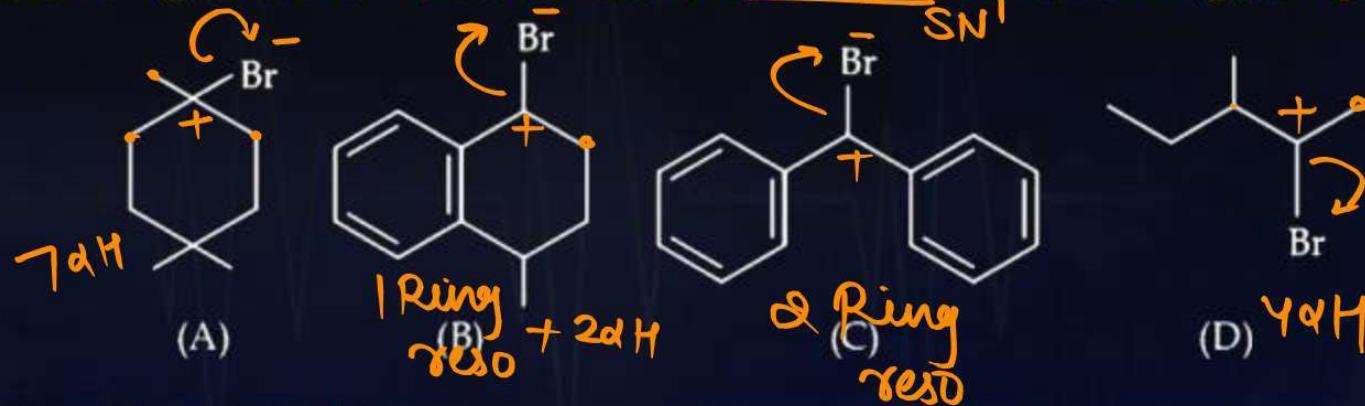
In the light of the above statements, choose the most appropriate answer from the options given below:

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

C.Q. 20 (JEE Mains 2025, 23 January Shift-2)



The ascending order of relative rate of solvolytic solvolysis of following compounds is:



- A** (C) < (D) < (B) ~~(A)~~
- B** ~~(D) < (A) < (B) < (C)~~
- C** (D) < (B) < (A) < (C)
- D** (C) < (B) < (A) < ~~(D)~~

C.Q. 21 (JEE Mains 2025, 24 January Shift-2)



The structure of the major product formed in the following reaction is:

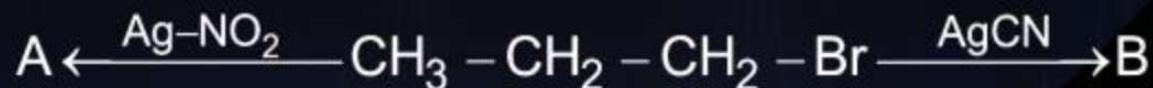


- A
B
C
D

C.Q. 22 (JEE Mains 2025, 28 January Shift-1)



The products A and B in the following reactions respectively are:

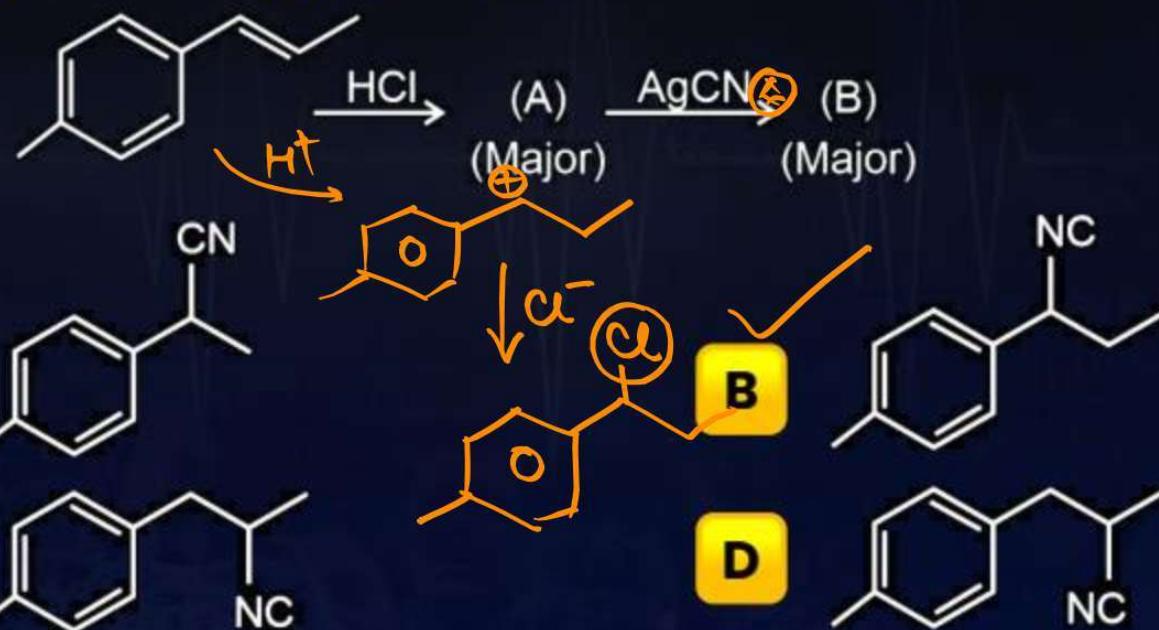


- A** $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NO}_2, \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CN}$
- B** $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{ONO}, \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CN}$
- C** $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{ONO}, \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NC}$
- D** $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NO}_2, \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{NC}$

C.Q. 23 (JEE Mains 2025, 28 January Shift-2)

PW

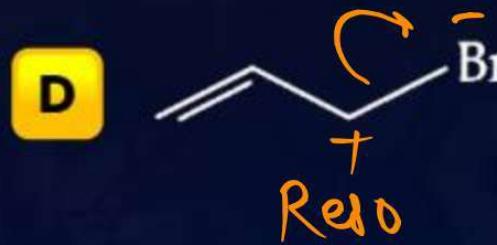
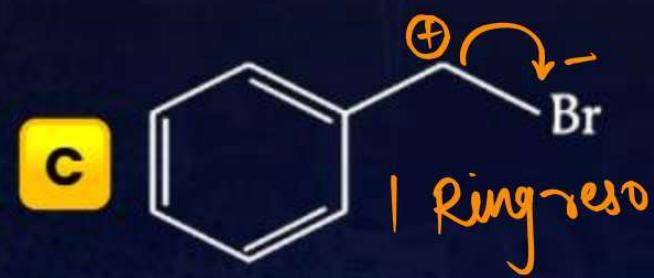
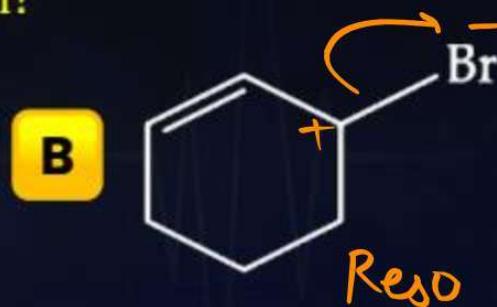
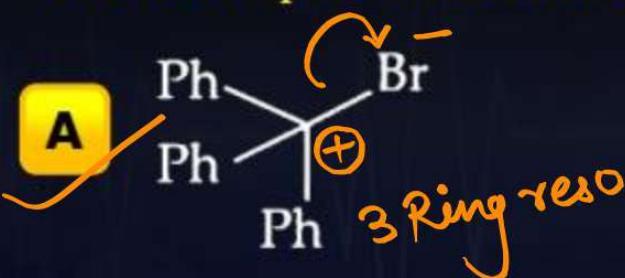
Identify product [A], [B] and [C] in the following reaction sequence.



C.Q. 24 (JEE Mains 2025, 29 January Shift-2)

PW

Which among the following halides will generate the most stable carbocation in the nucleophilic substitution reaction?

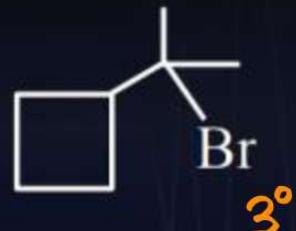


C.Q. 25 (JEE Mains 8th April 2024, Morning Shift)



Which among the following compounds will undergo fastest S_N2 reaction?

A



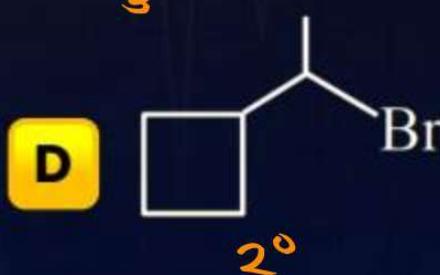
B



C



D



C.Q. 26 (JEE Mains 30th January 2024, Evening Shift)



Given below are two statements:

Statement-I: High concentration of strong nucleophilic reagent with secondary alkyl halides which do not have bulky substituents will follow S_N2 mechanism.

Statement-II: A secondary alkyl halide when treated with a large excess of ethanol follows S_N1 mechanism.

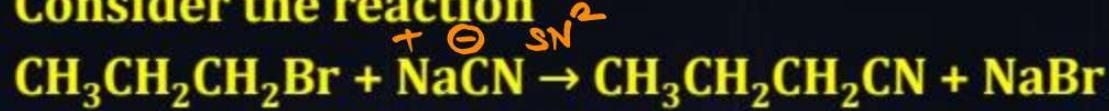
EtOH
Solvolyysis

- A Statement I is true but Statement II is false.
- B Statement I is false but Statement II is true.
- C Both statement I and Statement II are false.
- D Both statement I and Statement II are true.

C.Q. 27 [NEET 2016]



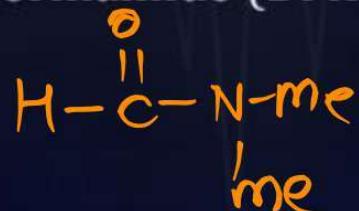
Consider the reaction



This reaction will be the fastest in:

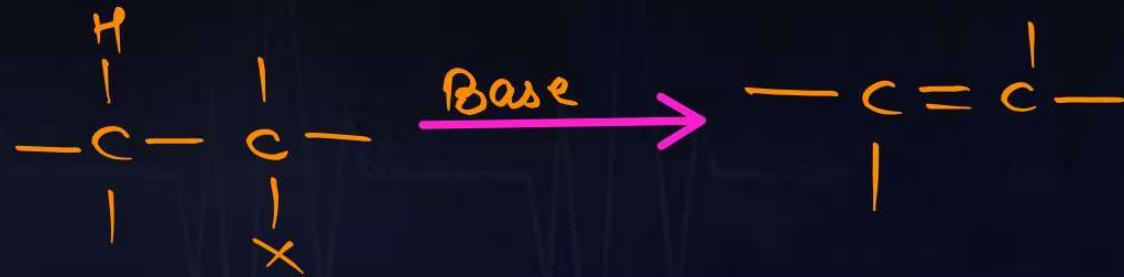
PAS

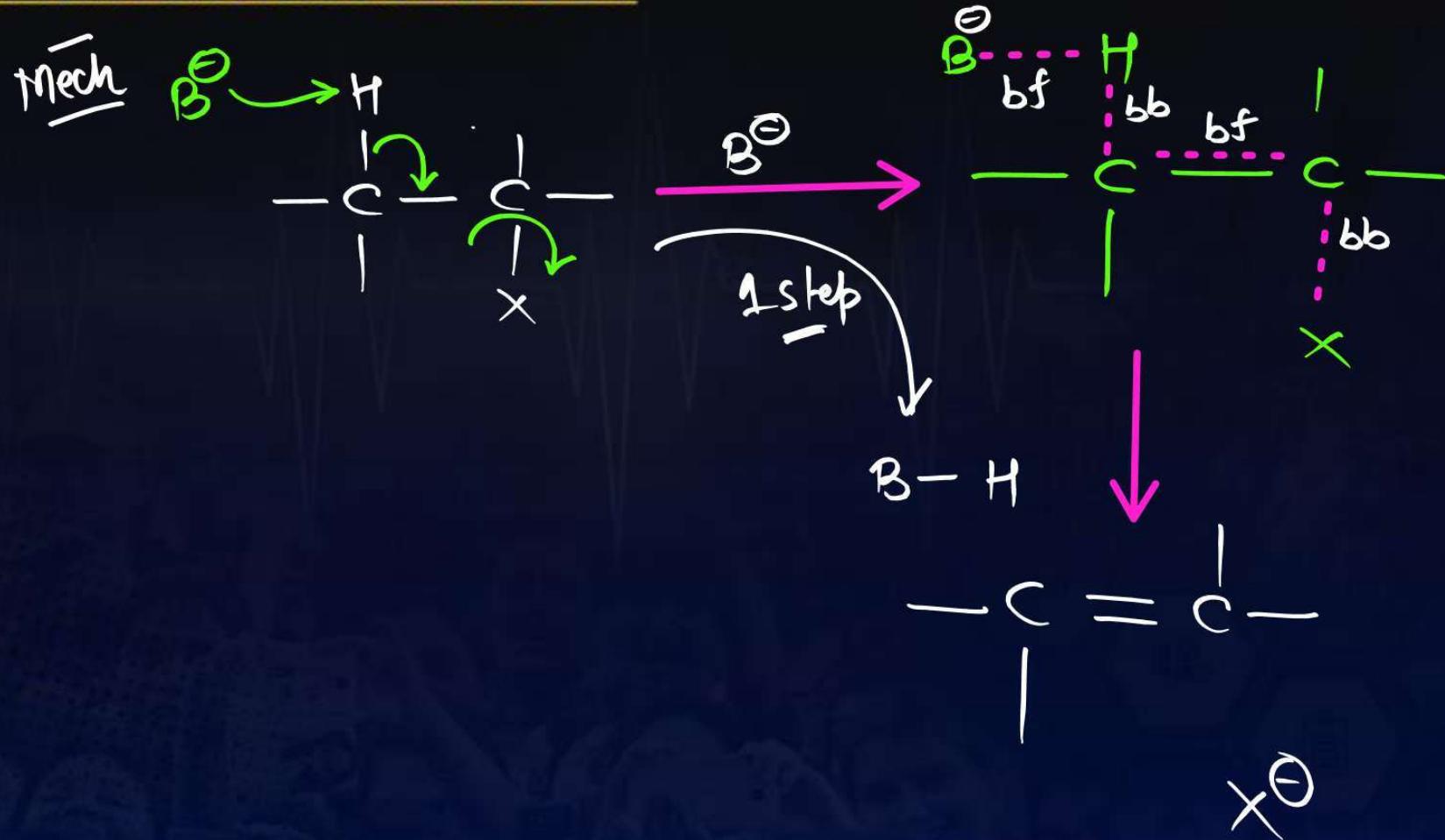
- A N, N'-dimethylformamide (DMF)
- B Water
- C Ethanol
- D Methanol



Elimination Reactions:

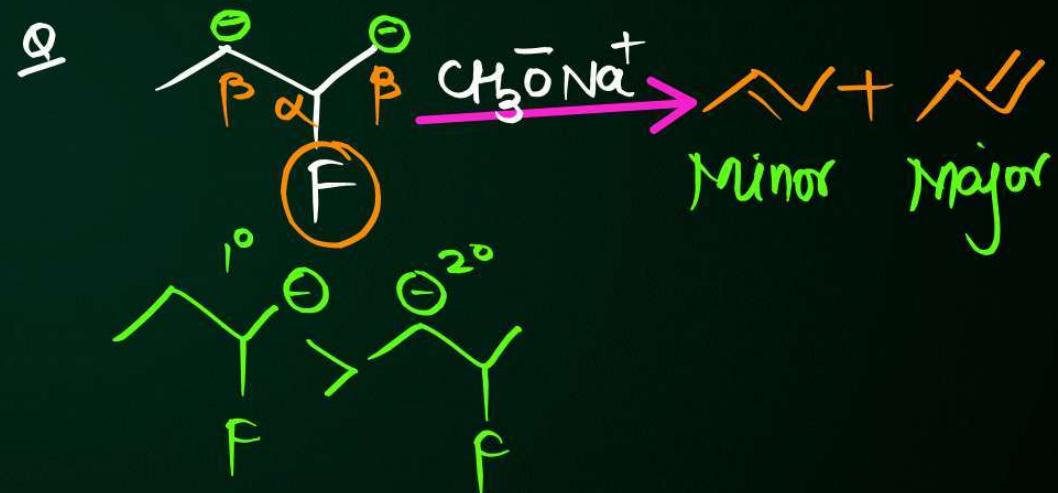
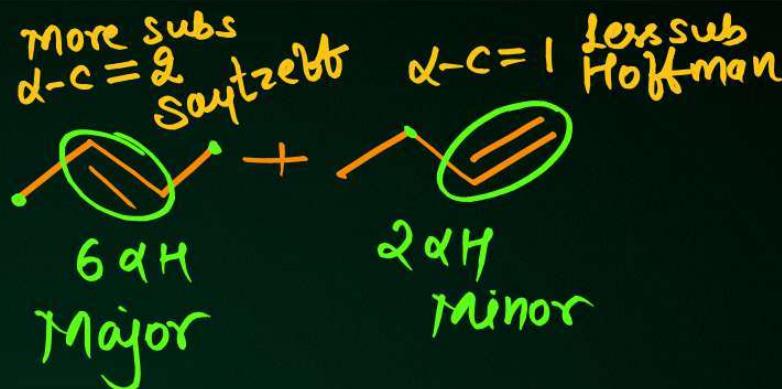
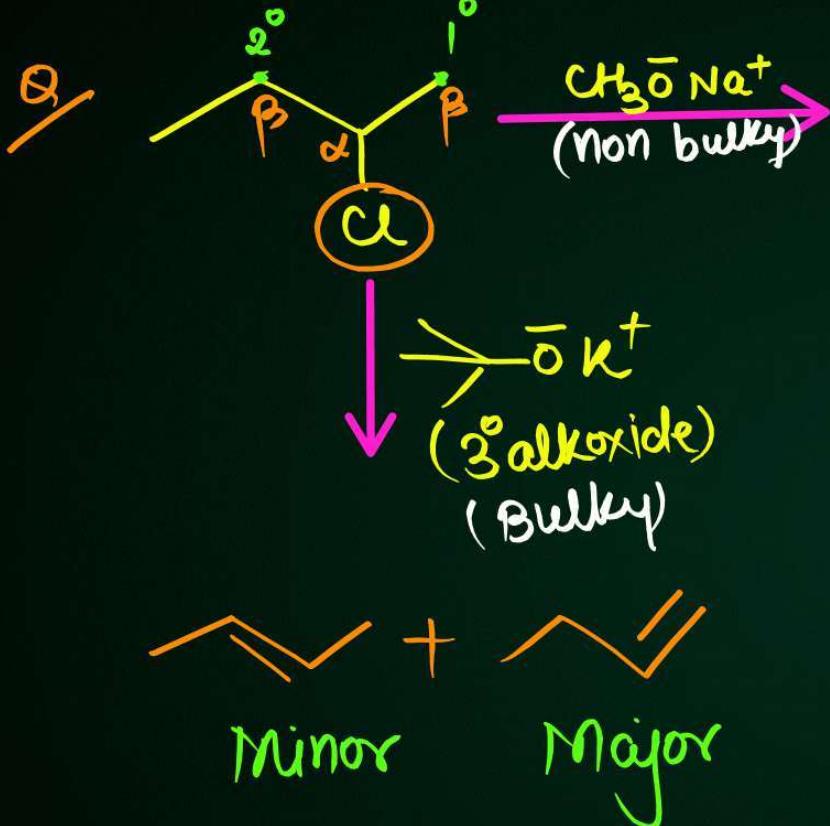
F^2



Elimination Reaction E 2:

OP Points of E 2:

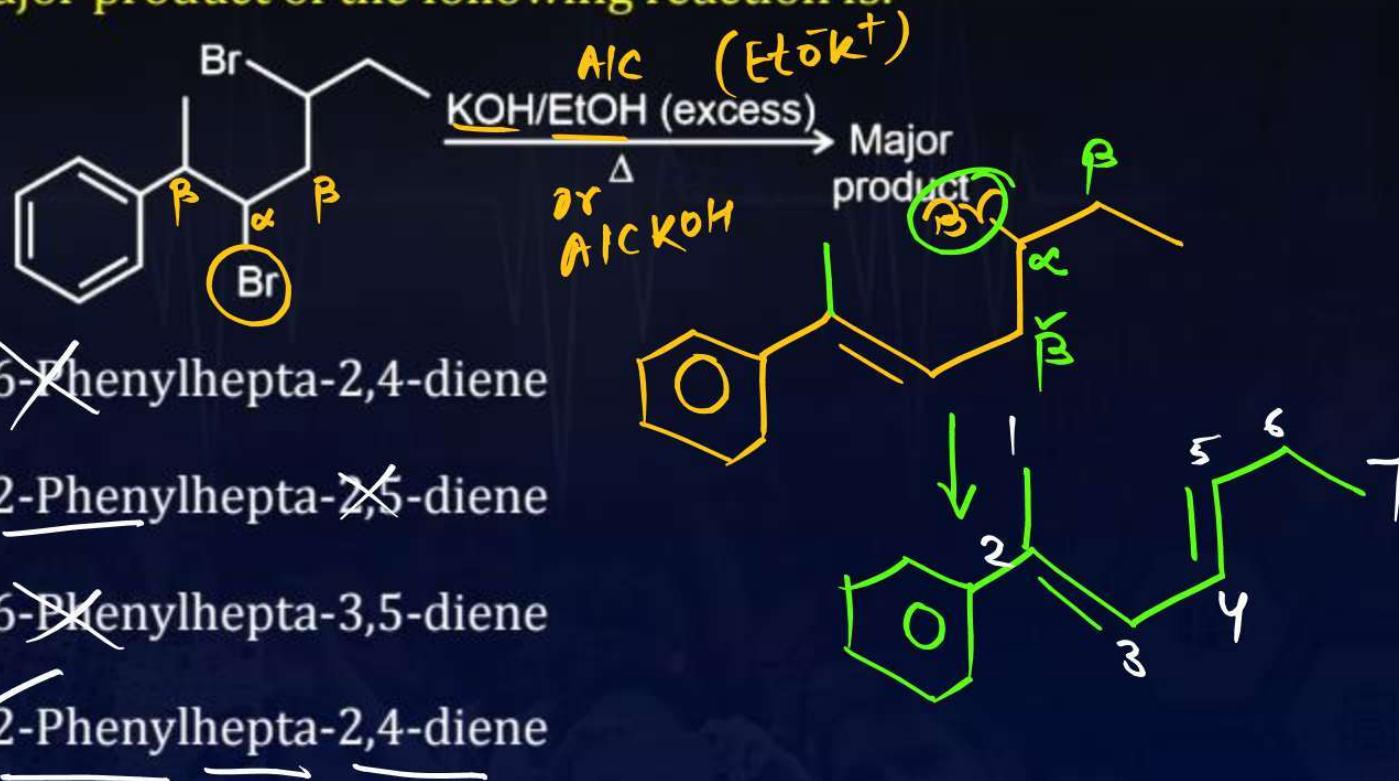
1. No Carbocation formation, Only Transition state is formed.
2. No Rearrangement
3. R.O.R w.r.t. Halogen $R - F < R - Cl < R - Br < R - I$ $[BE \downarrow \text{Leaving ability} \uparrow]$
4. Rate $r = k[R-X]^1[B^-]^4$
5. Order = 2 & Molecularity = 2
6. Anti Elimination (Mama mawii)
7. More stable alkene is the major product when L.G is Cl, Br & I. (Buaji)
8. More stable carbanion will decide the major product when L.G is E.
9. If Bulky base is present then less hindered beta carbon will decide the major product.



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

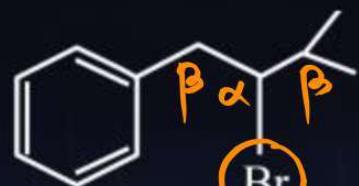


The major product of the following reaction is:



C.Q. 29 (JEE Mains 4th April 2024, Evening Shift)

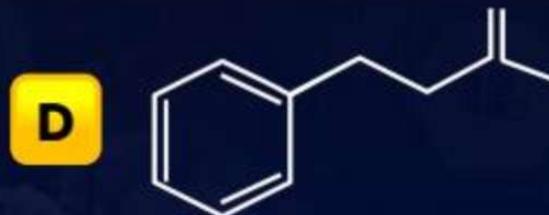
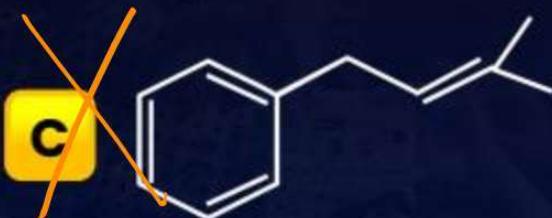
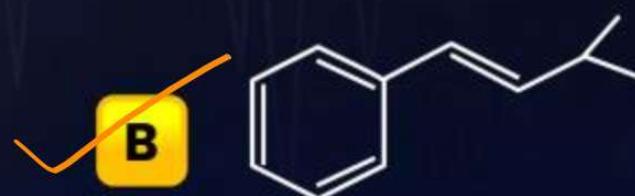
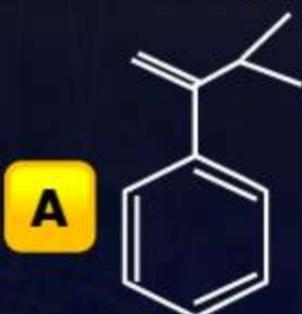
PW



$\xrightarrow[\Delta]{\text{KOH(alc)}}$

major product "P". Product P is:

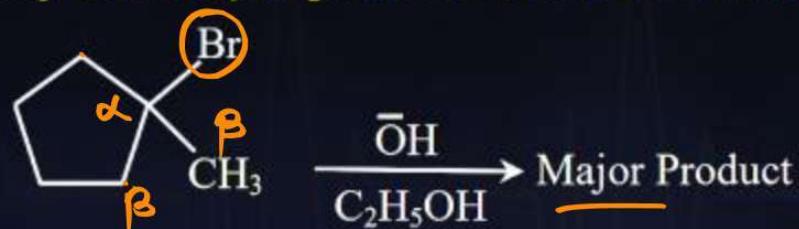
Reso > Hyper



C.Q. 30 (JEE Mains 5th April 2024, Evening Shift)

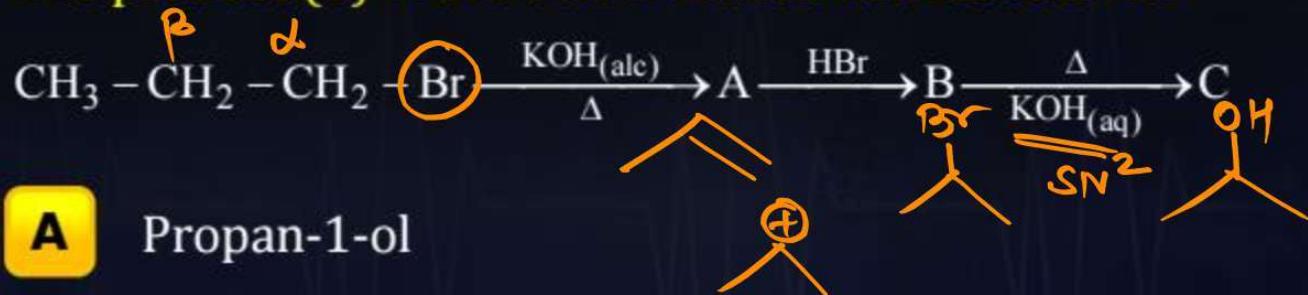


Identify the major product in the following reaction.



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

The product (C) in the below mentioned reaction is:

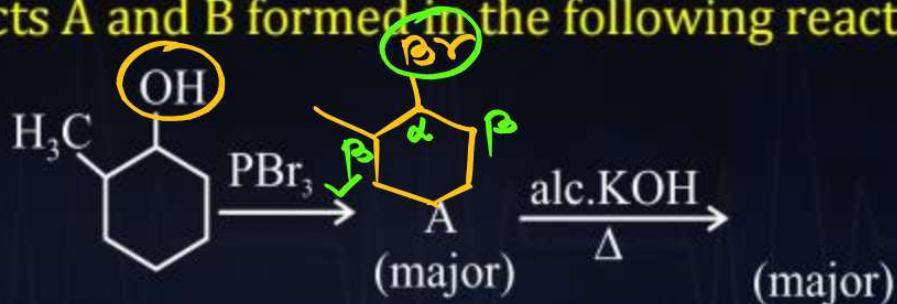


- A** Propan-1-ol
- B** Propene
- C** Propyne
- D** Propan-2-ol

C.Q. 32 (NEET 2024)

PW

Major products A and B formed in the following reaction sequence are:



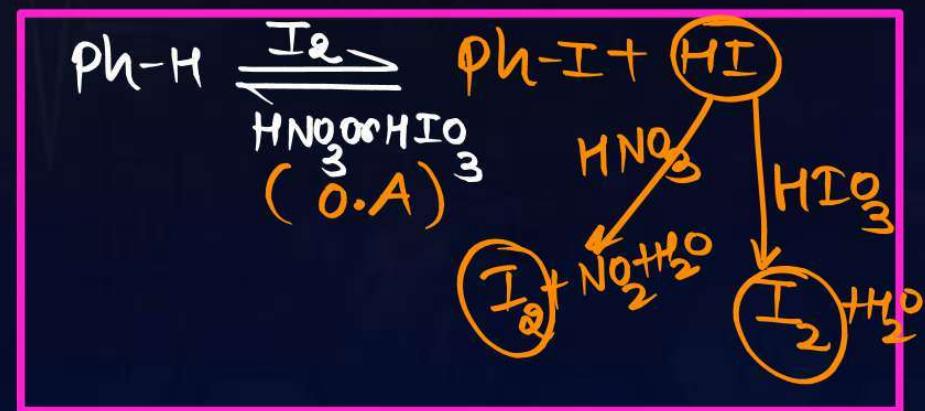
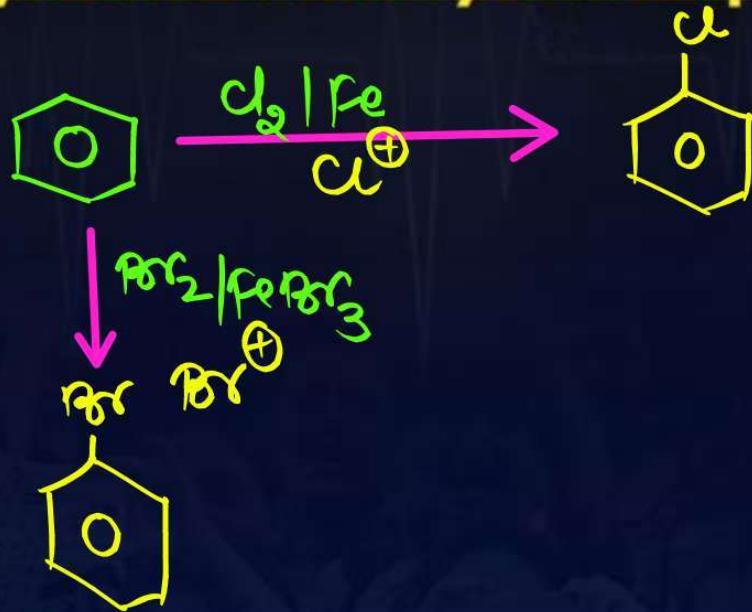
- A** $\text{A} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4\text{OH} \\ | \\ \text{Br} \end{array}$; $\text{B} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4\text{OH} \\ | \\ \text{Br} \end{array}$
- B** $\text{A} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4\text{OH} \\ | \\ \text{Br} \end{array}$; $\text{B} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4\text{O} \\ | \\ \text{Br} \end{array}$
- C** $\text{A} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4\text{Br} \\ | \\ \text{Br} \end{array}$; $\text{B} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4 \\ | \\ \text{Br} \end{array}$
- D** $\text{A} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4\text{Br} \\ | \\ \text{Br} \end{array}$; $\text{B} = \begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{C}_6\text{H}_4 \\ | \\ \text{Br} \end{array}$





Methods of Preparation of Haloarenes

1. From hydrocarbons by electrophilic substitution:

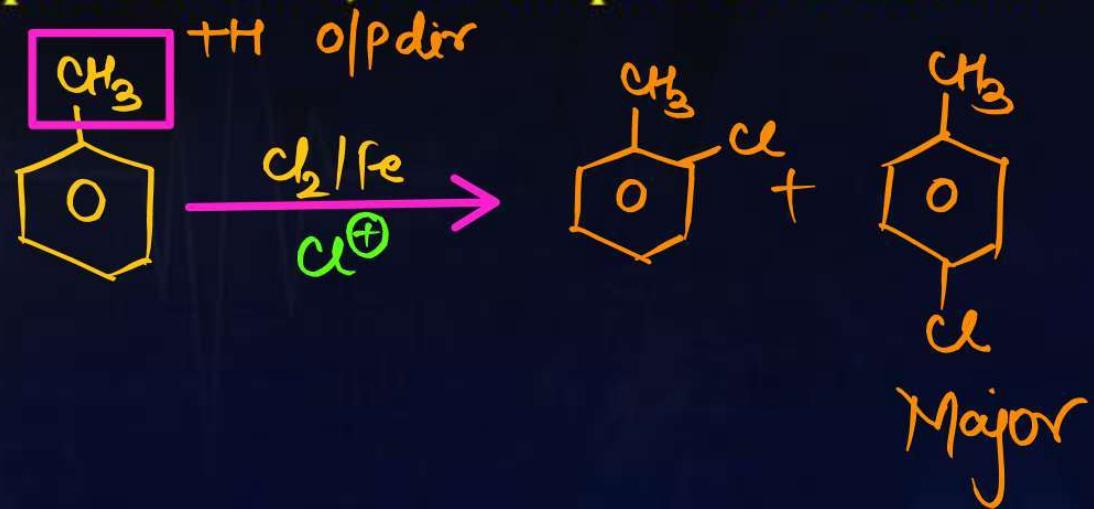


C.Q. 33

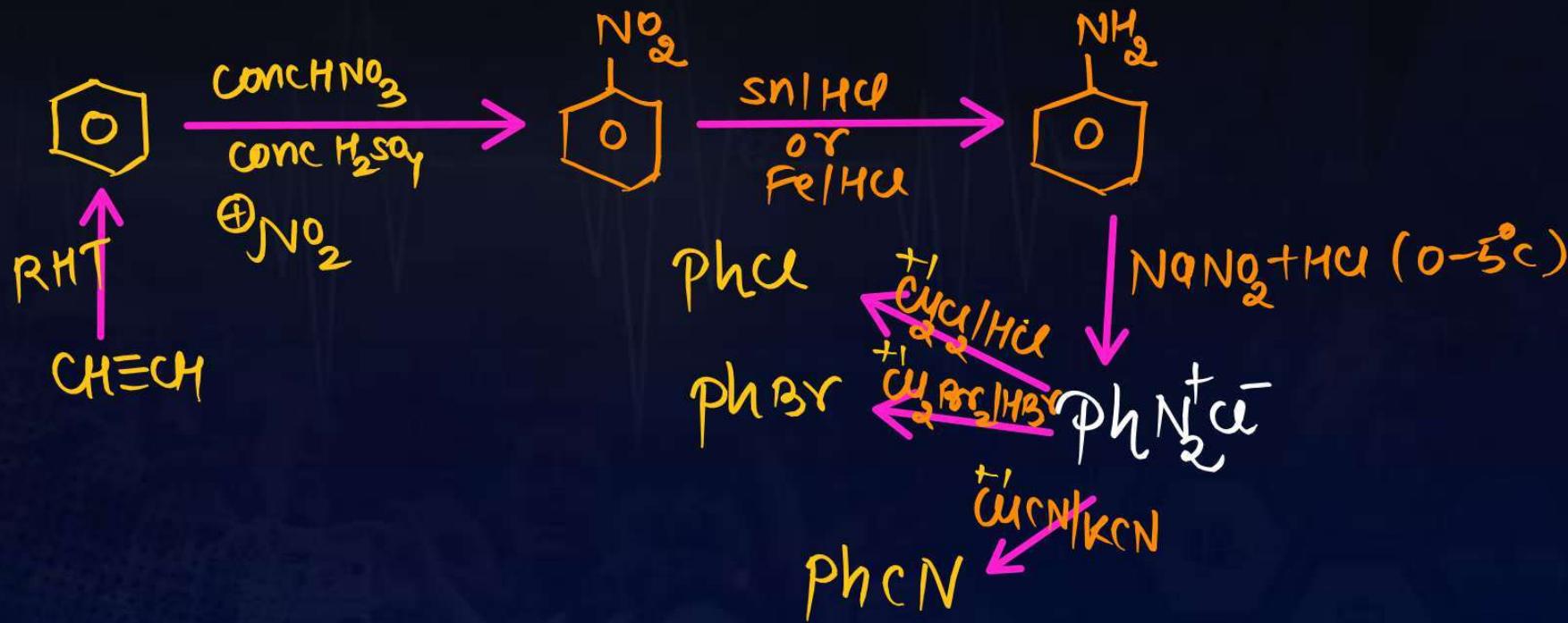


On treatment of Toluene with Cl_2 in presence of Fe, dark the product formed is:

- A o-and p-chloro Toluene
- B Benzyl chloride
- C m-chloro Toluene
- D only p-chloro Toluene



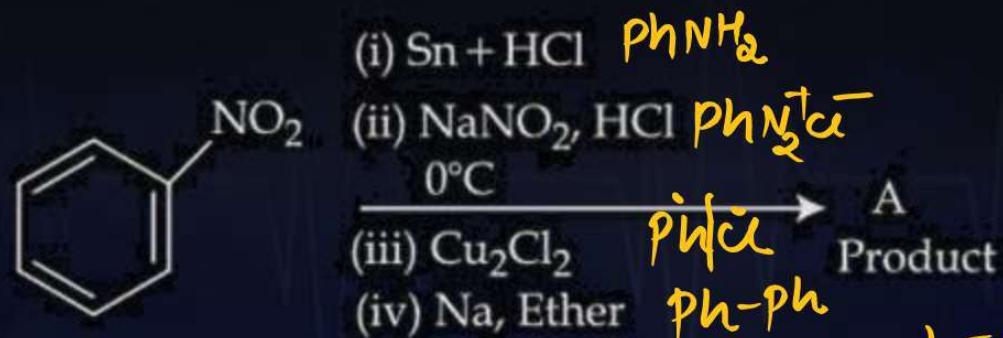
2. From Amines by Sandmeyer's reaction:



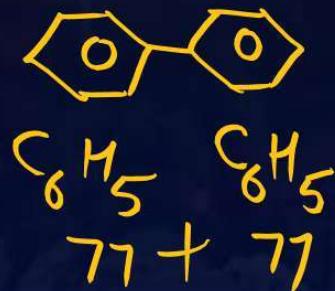
C.Q. 34 (JEE Mains 2025, 22 January Shift-1)



Consider the following sequence of reactions:



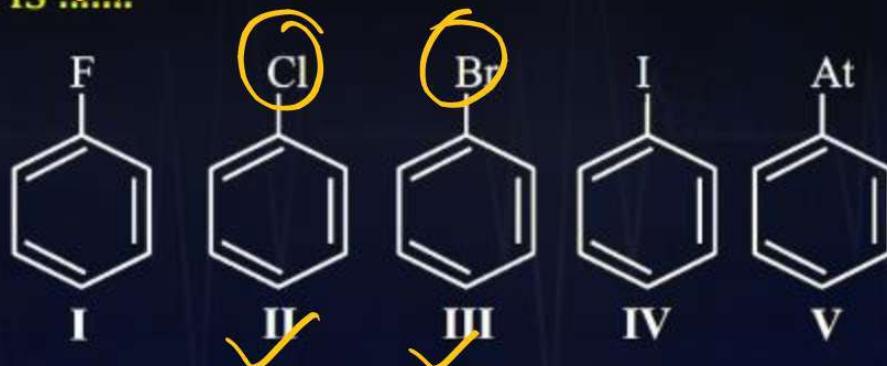
Molar mass of the product formed (A) is 154 g mol⁻¹.



C.Q. 35 (JEE Mains 5th April 2024, Morning Shift)



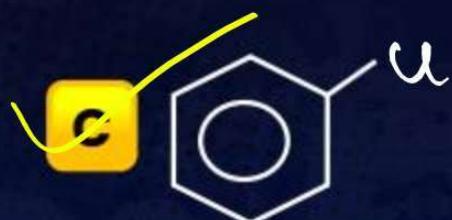
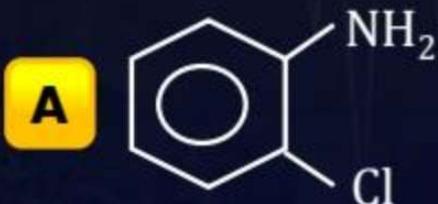
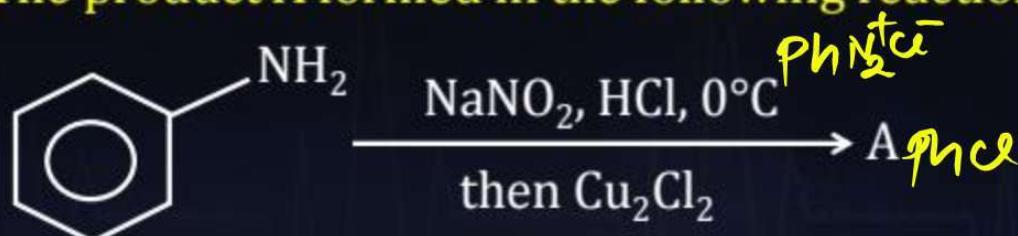
The number of halobenzenes from the following that can be prepared by Sandmeyer's reaction is ...



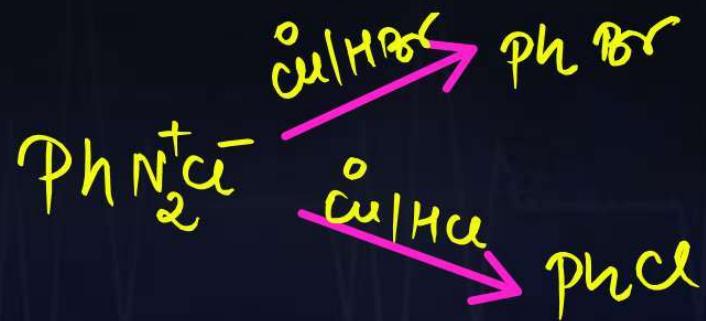
C.Q. 36 (JEE Mains 29th January 2024, Evening Shift)



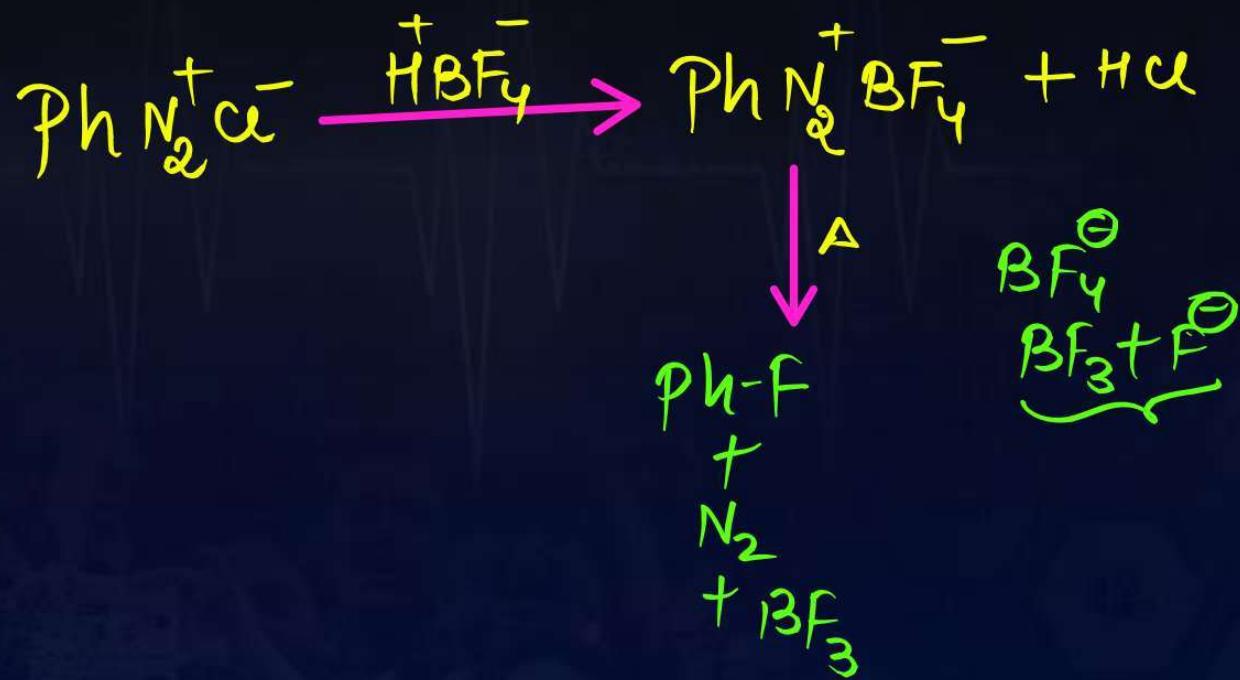
The product A formed in the following reaction is:



3. From Amines by Gattermann reaction:



4. From Amines by Balz-Schiemann reaction:



C.Q. 37



Aryl fluoride may be prepared from arene diazonium chloride using:

A HBF_4/Δ

B $\text{HBF}_4/\text{NaNO}_2, \text{Cu}, \Delta$

C CuF/HF

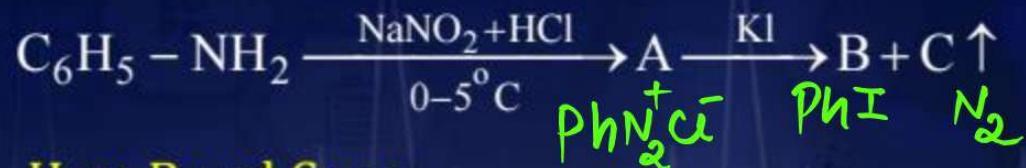
D Cu/HF



5. Sizzi sir's reaction:

Aryl iodide

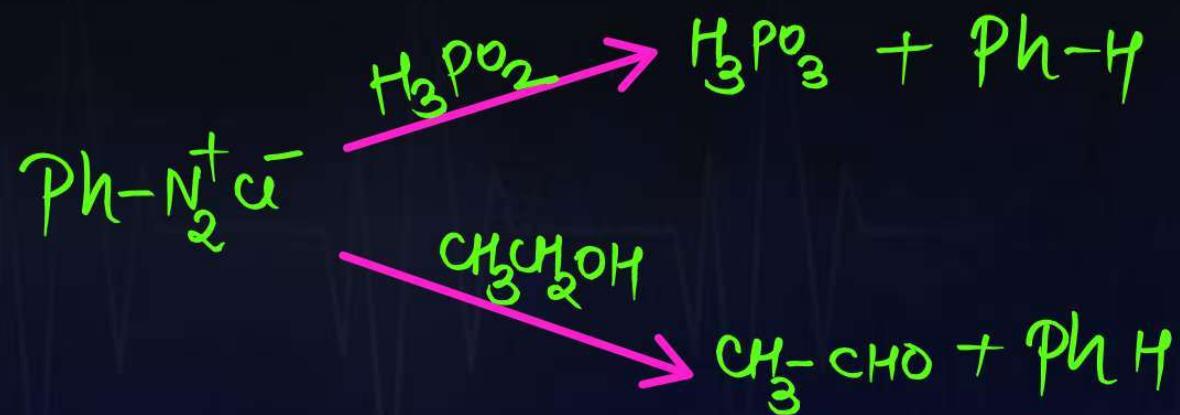


C.Q. 38

Here B and C are:

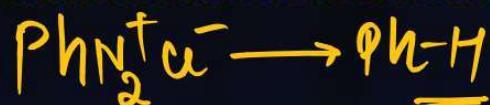
- A $\text{C}_6\text{H}_5\text{I}, \text{N}_2$
- B $\text{C}_6\text{H}_5\text{I}, \text{O}_2$
- C $\text{C}_6\text{H}_6, \text{I}_2$
- D $\text{C}_6\text{H}_5\text{CH}_2\text{I}, \text{N}_2$

6. Reduction Reaction:



C.Q. 39 (NCERT Exemplar)

The reagents that can be used to convert benzenediazonium chloride to benzene are _____.

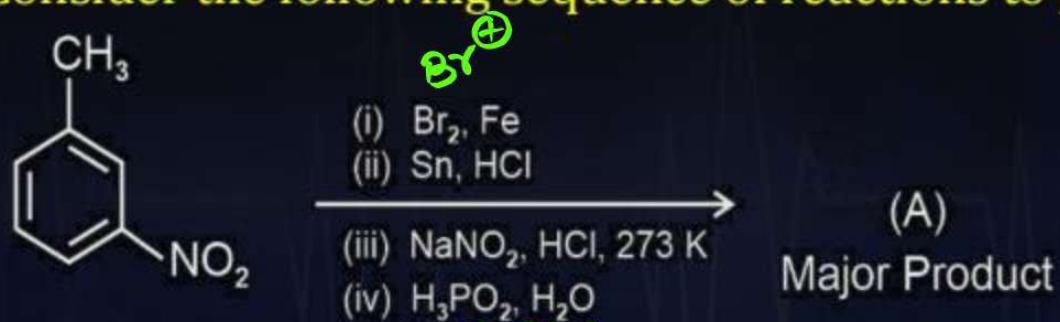


- A** SnCl₂/HCl
- B** CH₃CH₂OH
- C** H₃PO₂
- D** Both (B) & (C)

C.Q. 40 (JEE Mains 2025, 23 January Shift-1)

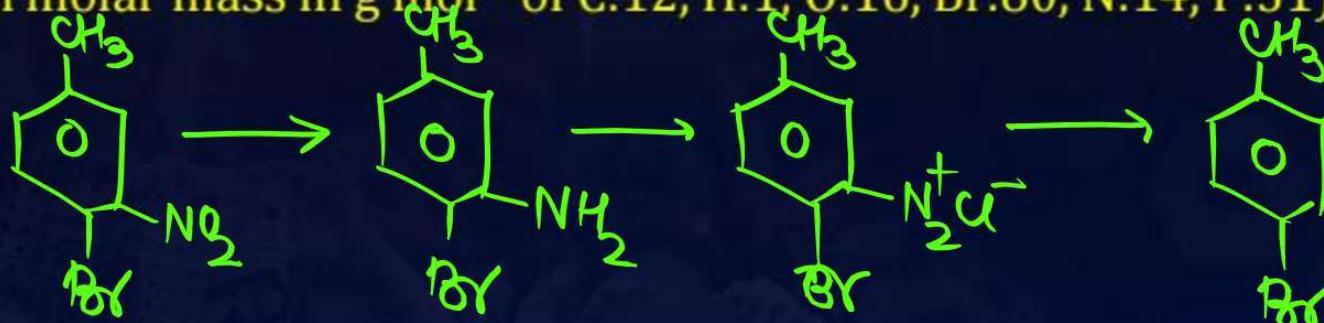


Consider the following sequence of reactions to produce major product (A)



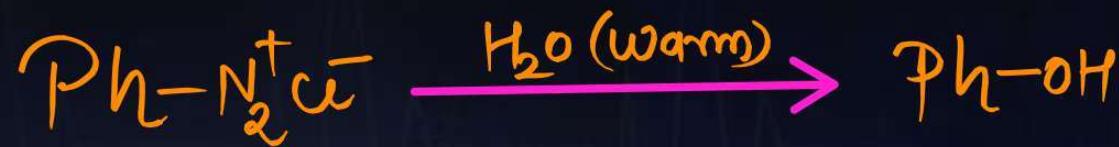
Molar mass of product (A) is 171 g mol⁻¹.

(Given molar mass in g mol⁻¹ of C:12, H:1, O:16, Br:80, N:14, P:31)



$$\begin{array}{r}
 \text{C}_6\text{H}_4 + \text{CH}_3 + \text{Br} \\
 \text{76} \\
 + \text{15} \\
 \hline
 \text{91} \\
 - \text{80} \\
 \hline
 \underline{\underline{171}}
 \end{array}$$

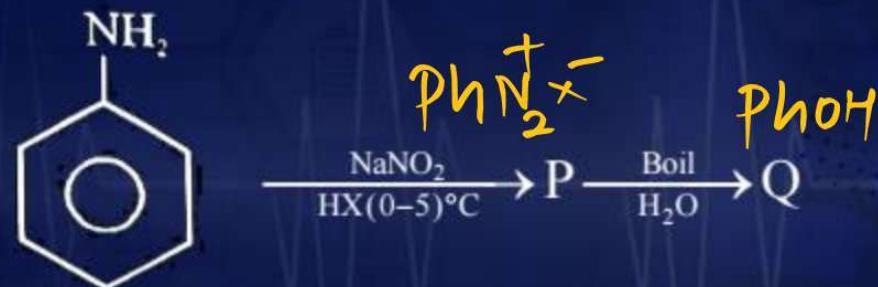
7. Reaction with warm water:



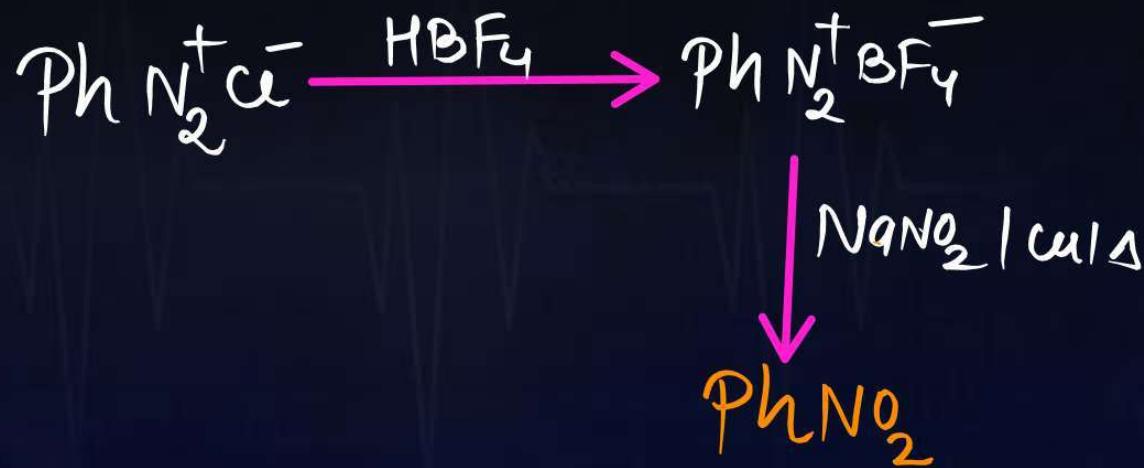
C.Q. 41

PW

The product Q in the following reaction sequence is:

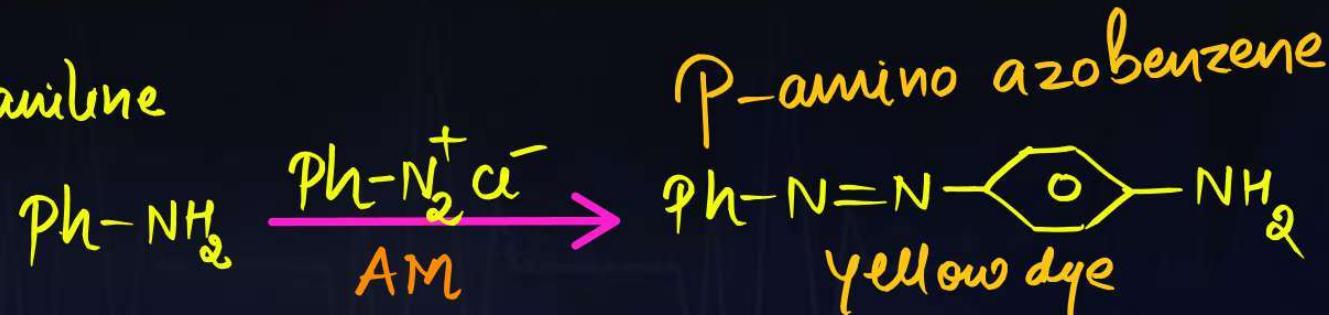


8. Preparation of Nitrobenzene:

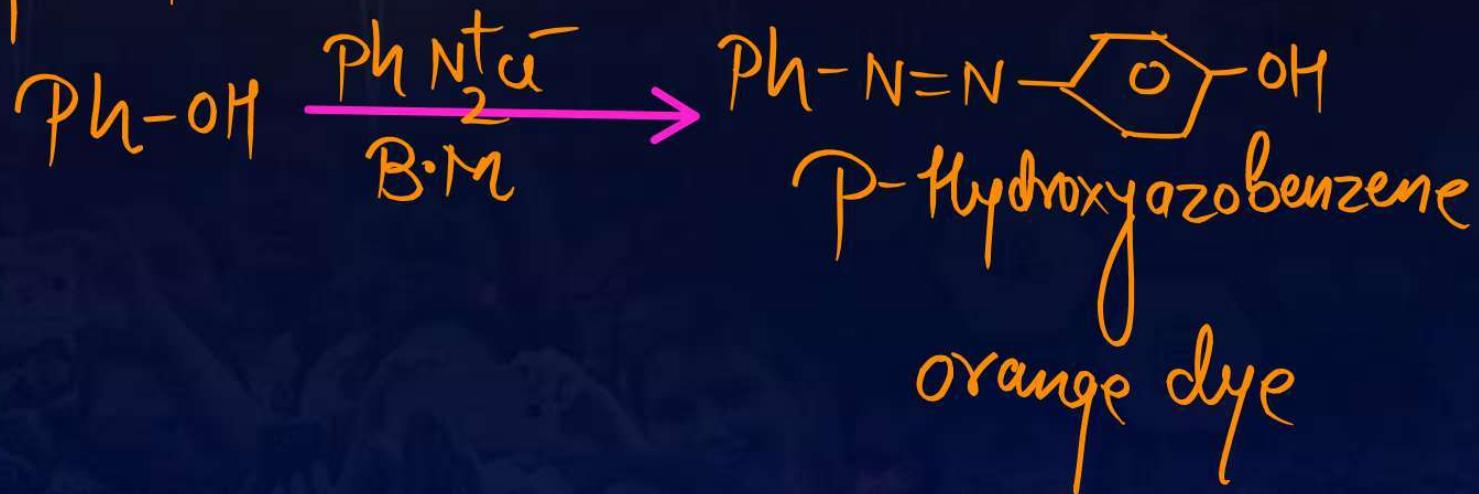


9. Coupling Reaction:

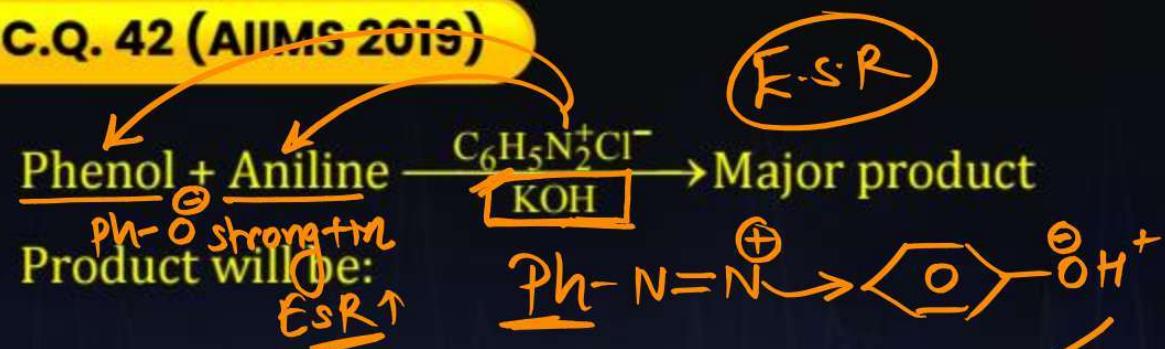
a) with aniline



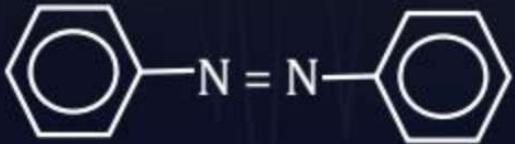
b) with phenol



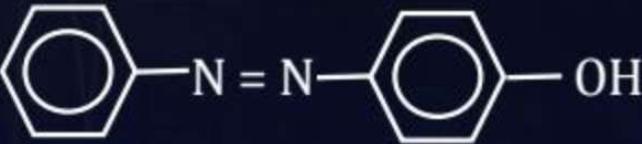
C.Q. 42 (AIIMS 2019)



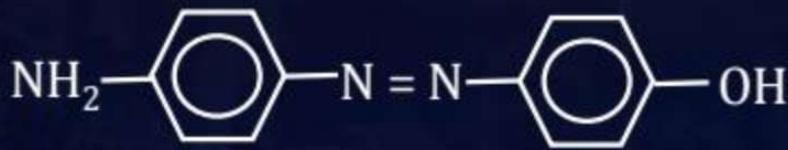
A



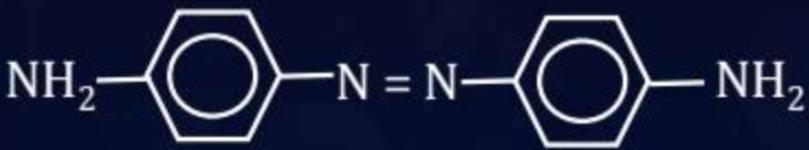
B



C



D





Chemical Properties of haloarenes

1. Nucleophilic Substitution Reactions:

Generally Aromatic N.S.R do not occurs why?



Reasons

1. Due to partial bond character b/w C and X



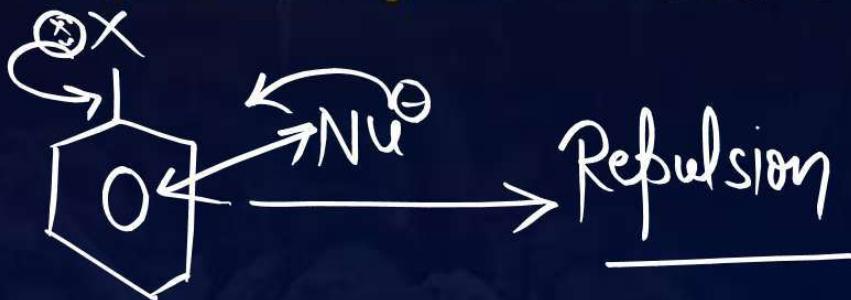
2. Due to instability of phenyl cations



3. Due to difference in hybridization of carbon of C-X bond

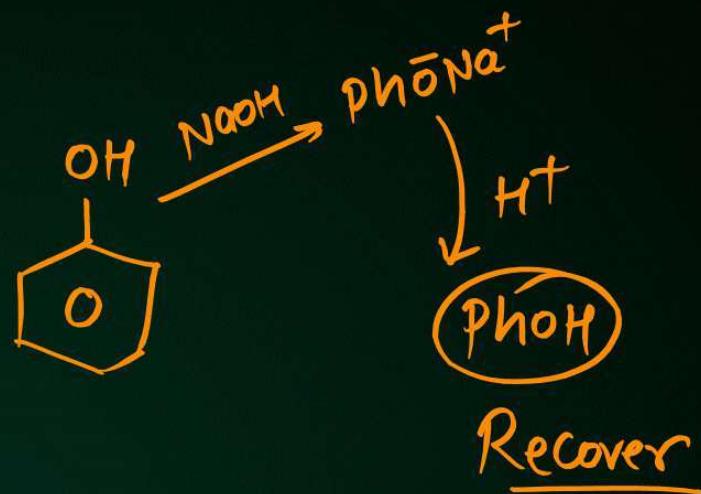
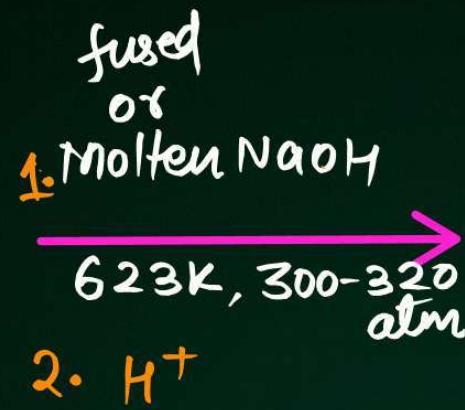


4. Due to repulsion b/w Nucleophile and electron rich haloarenes



L

Dow's process

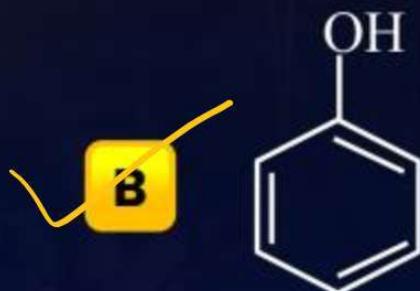
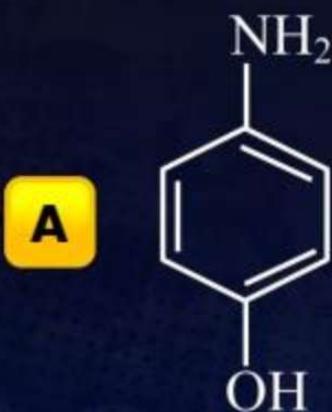
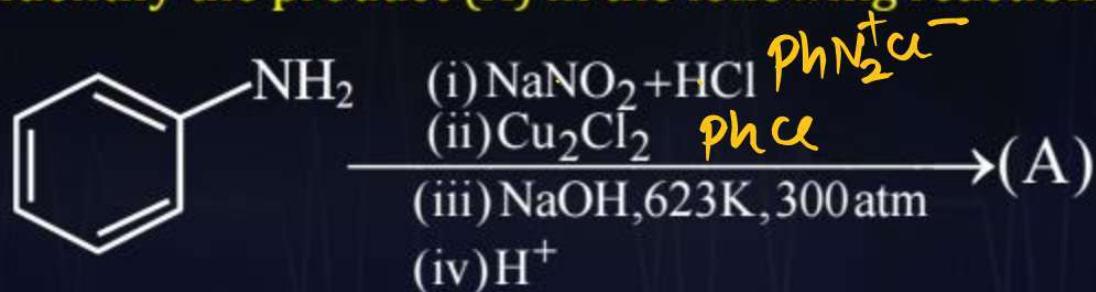


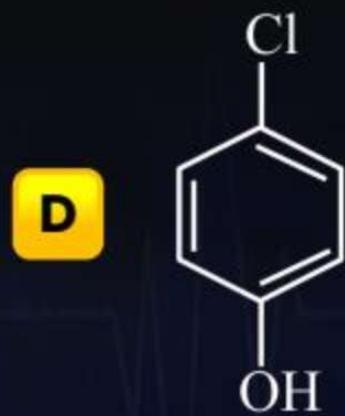
PW

C.Q. 43 (JEE Mains 6th April 2024, Evening Shift)

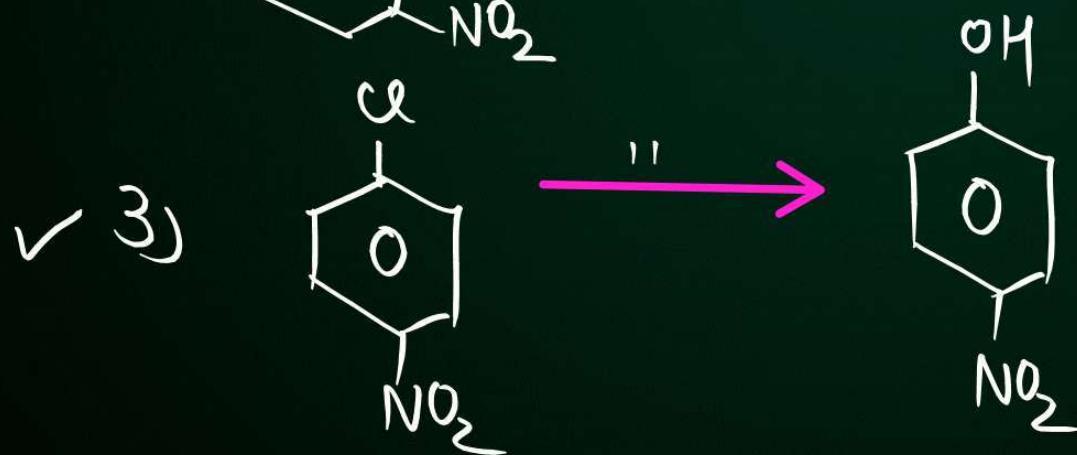
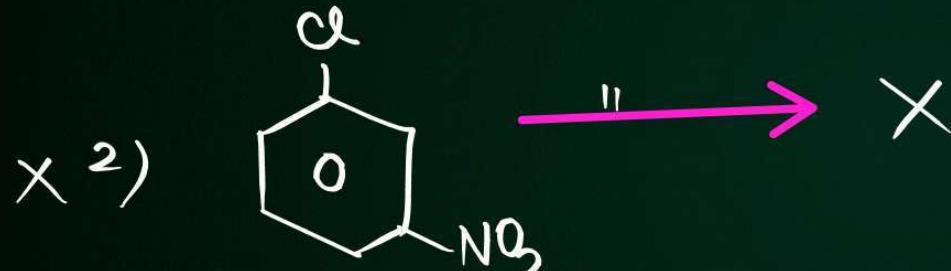
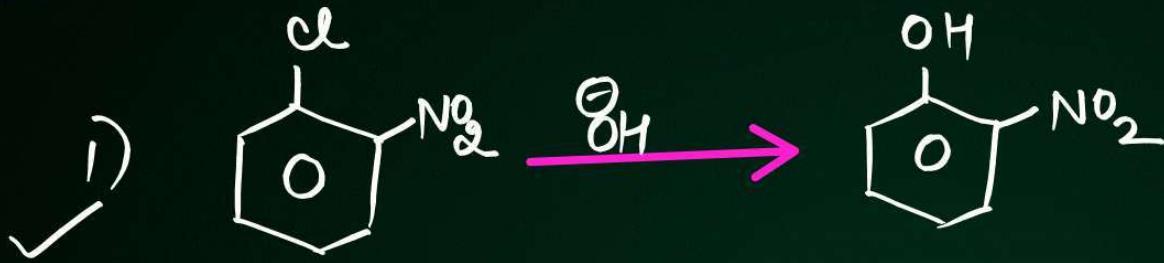


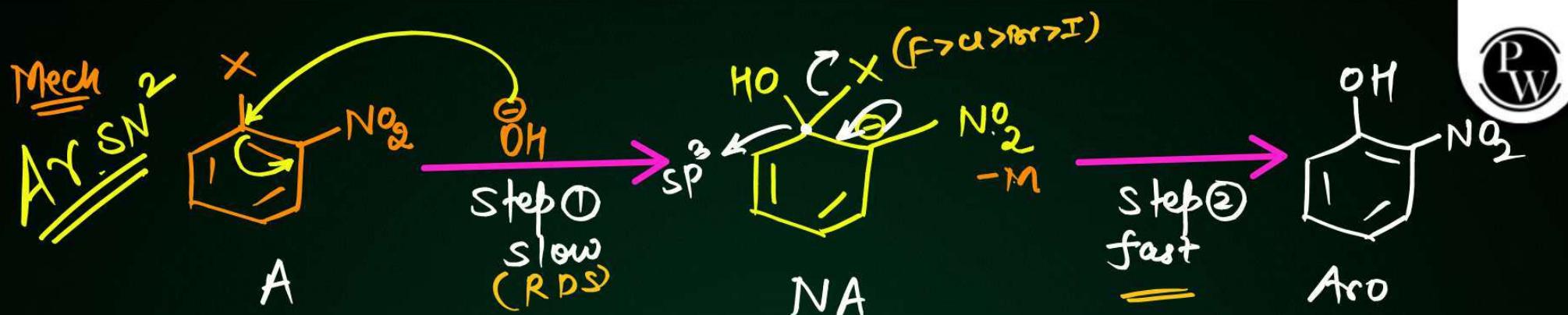
Identify the product (A) in the following reaction.





② ^{o,p} Nitro halo benzene can give NSR (Nucleophilic subs Rxn)





op points :-

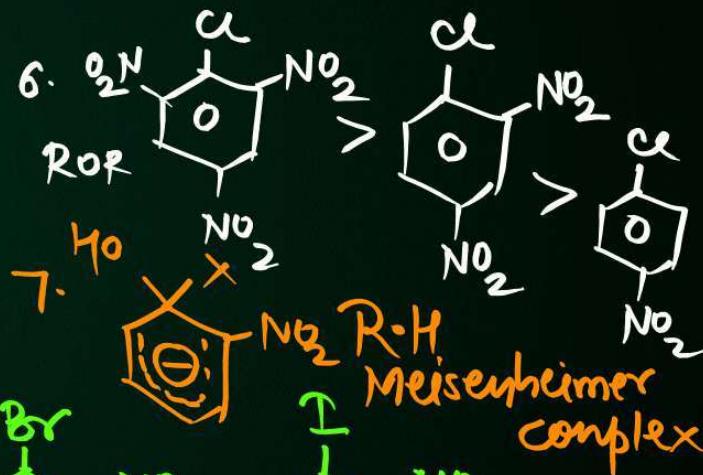
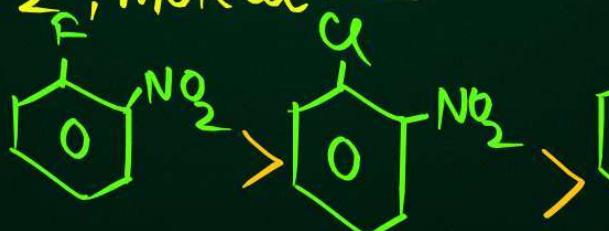
1. Carbanion intermediate

2. Step 1 is the R.D.S

$$k = K[\text{Nitrohalobenzene}]^{\frac{1}{2}}[\text{NU}^-]^{\frac{1}{2}}$$

4. order = 2, molecu = 2

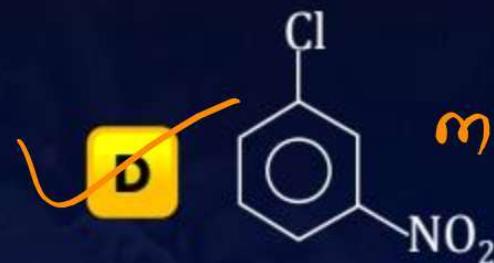
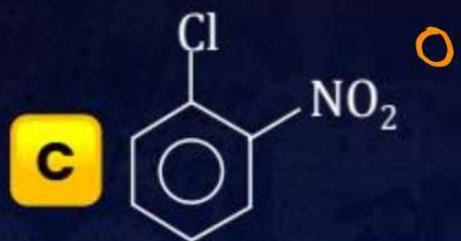
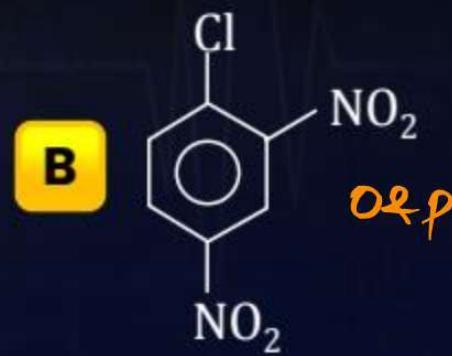
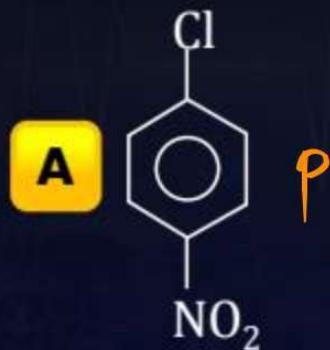
5. ROR



C.Q. 44 [25 Jan. 2023 (Shift-I)]



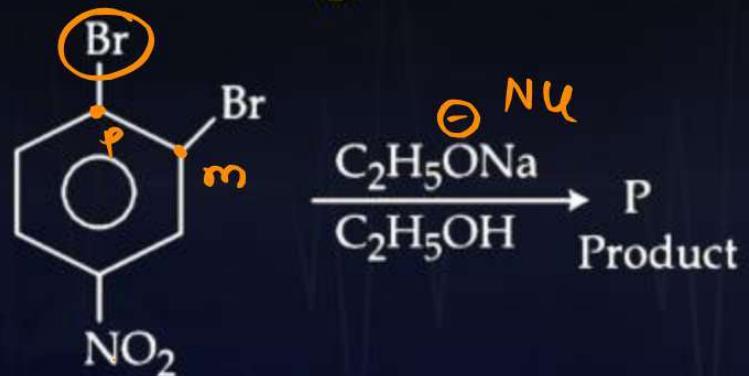
The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with OH^- is:



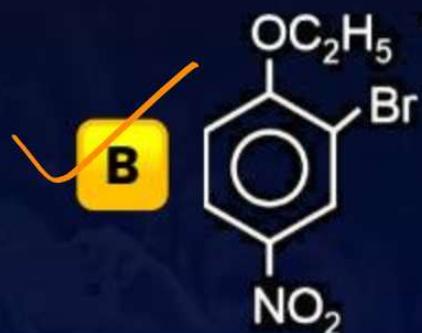
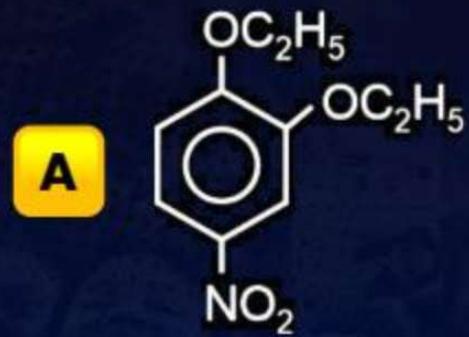
C.Q. 45 (JEE Mains 2025, 29 January Shift-1)

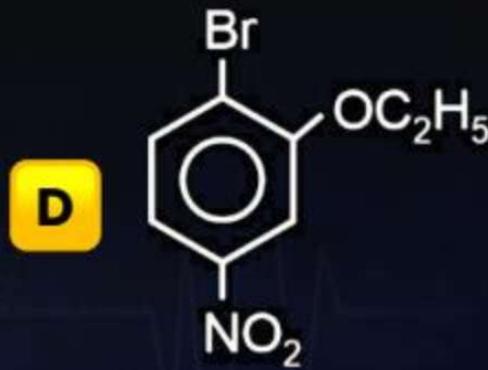
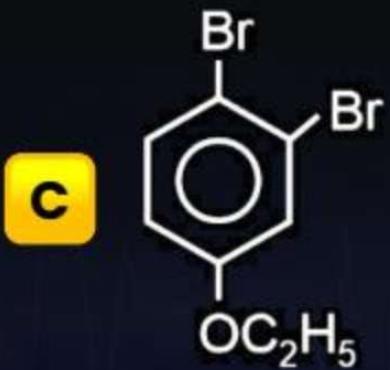


In the following substitution reaction:

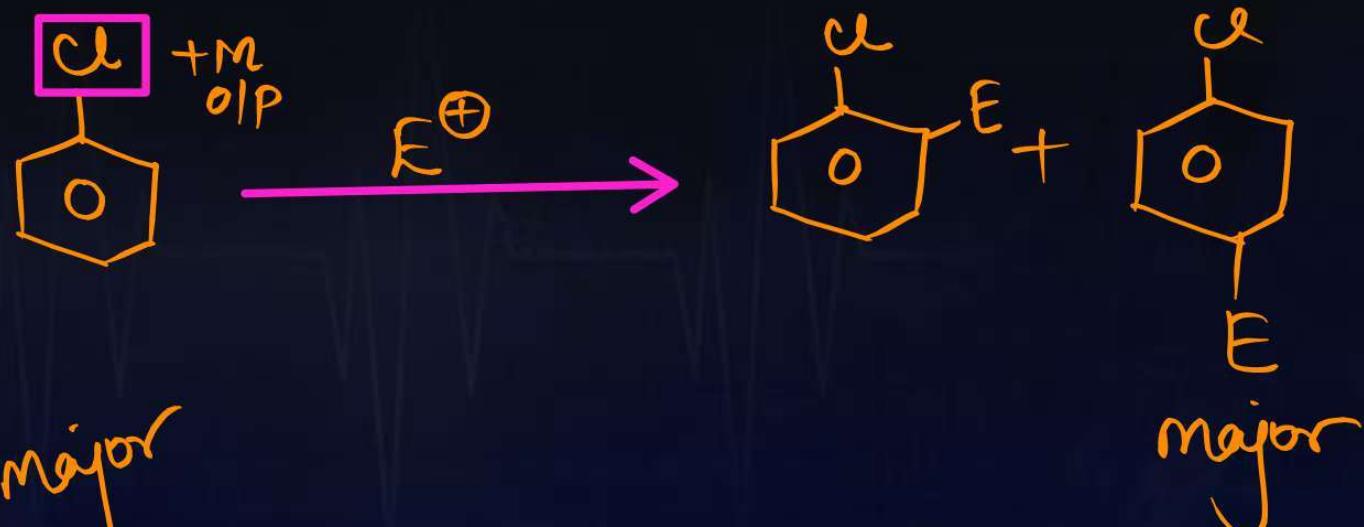


Product 'P' formed is:

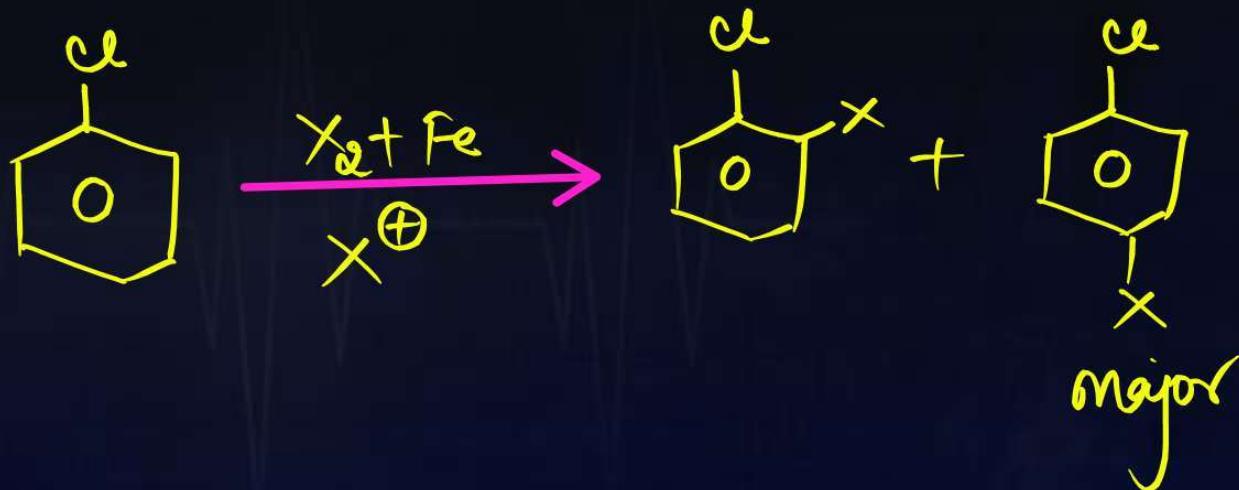




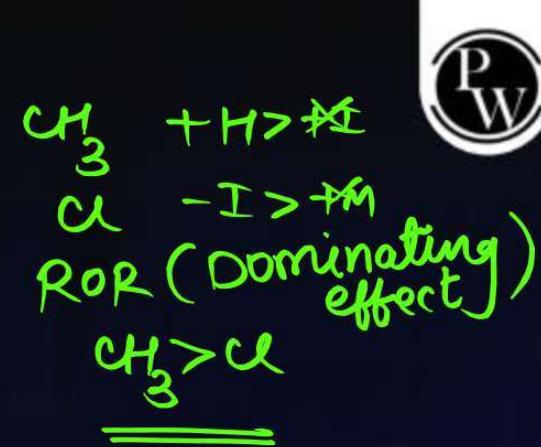
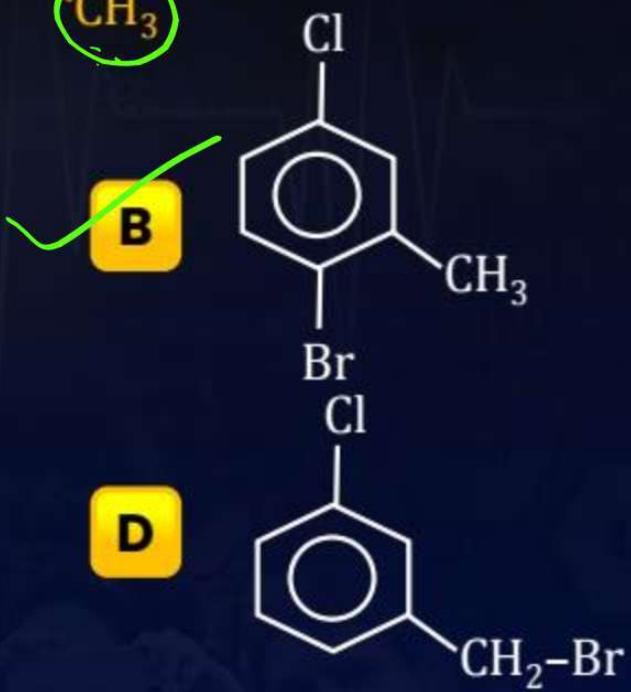
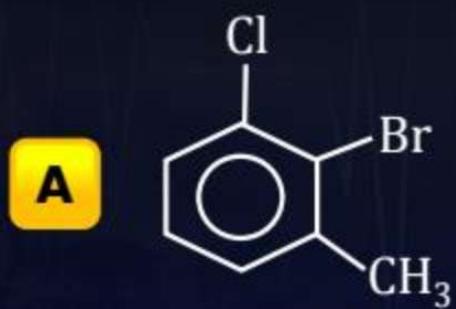
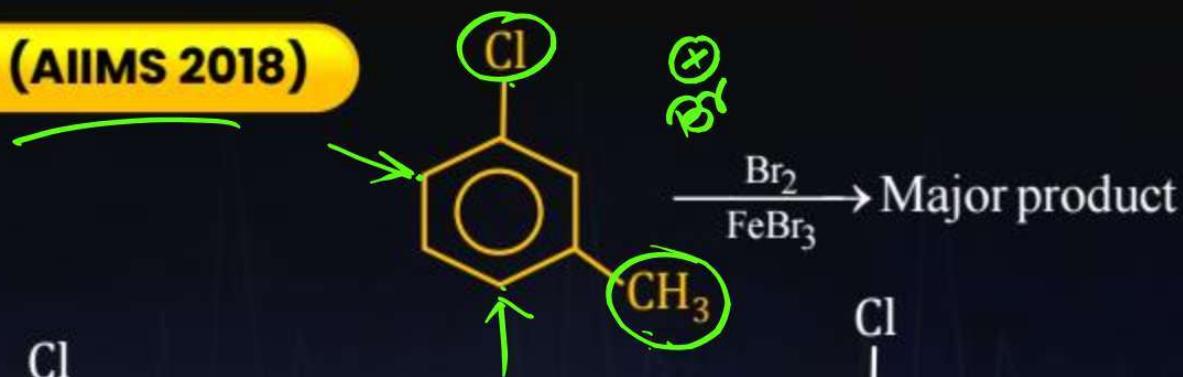
2. Electrophilic Substitution reactions:

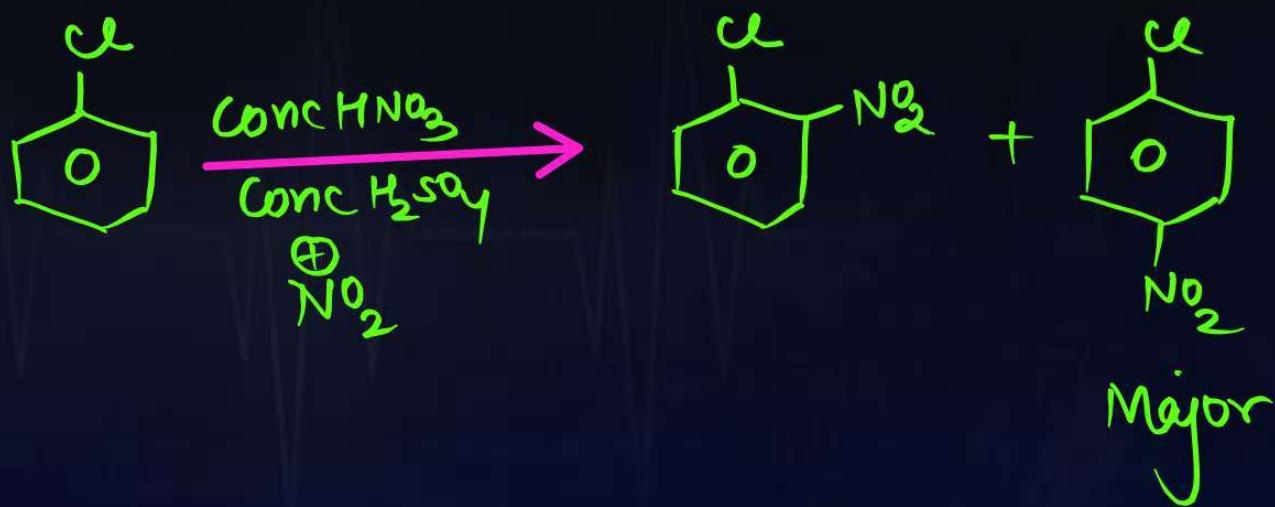


A. Halogenation:



C.Q. 46 (AIIMS 2018)



B. Nitration:

C.Q. 47 (NCERT Exemplar)

Assertion: Nitration of chlorobenzene leads to the formation of ~~m-nitro~~ ~~chlorobenzene~~.

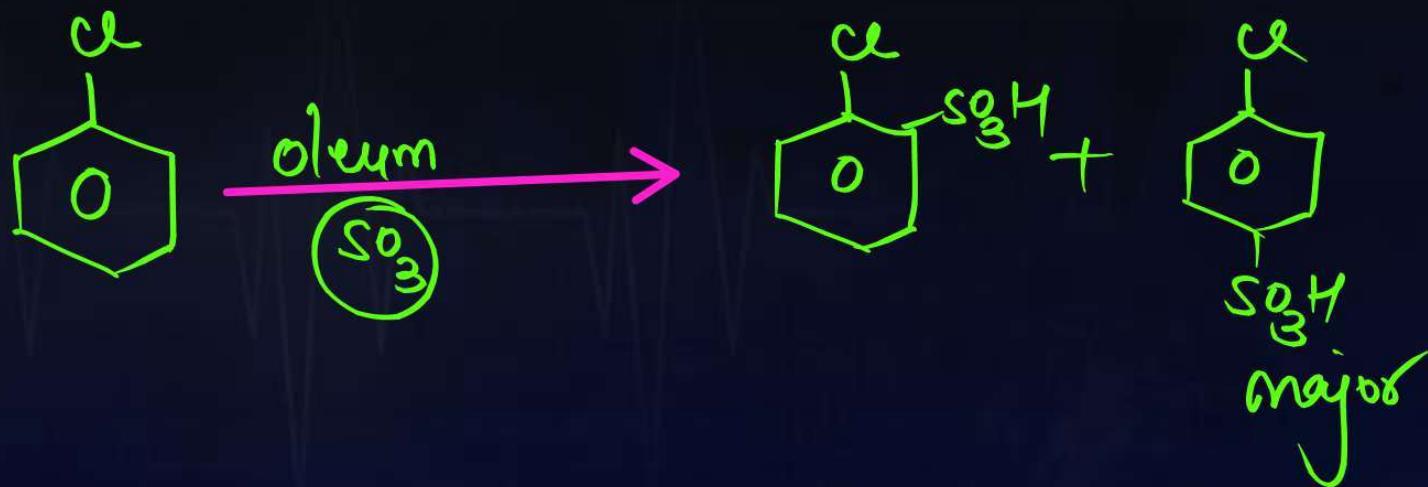
Reason: $-NO_2$ group is a *m*-directing group.



~~+M O/Pdrc~~

- A** Assertion and reason both are correct and reason is correct explanation of assertion.
- B** Assertion and reason both are wrong statements.
- C** Assertion is correct but reason is wrong statement.
- D** Assertion is wrong but reason is correct statement

C. Sulphonation:



C.Q. 48

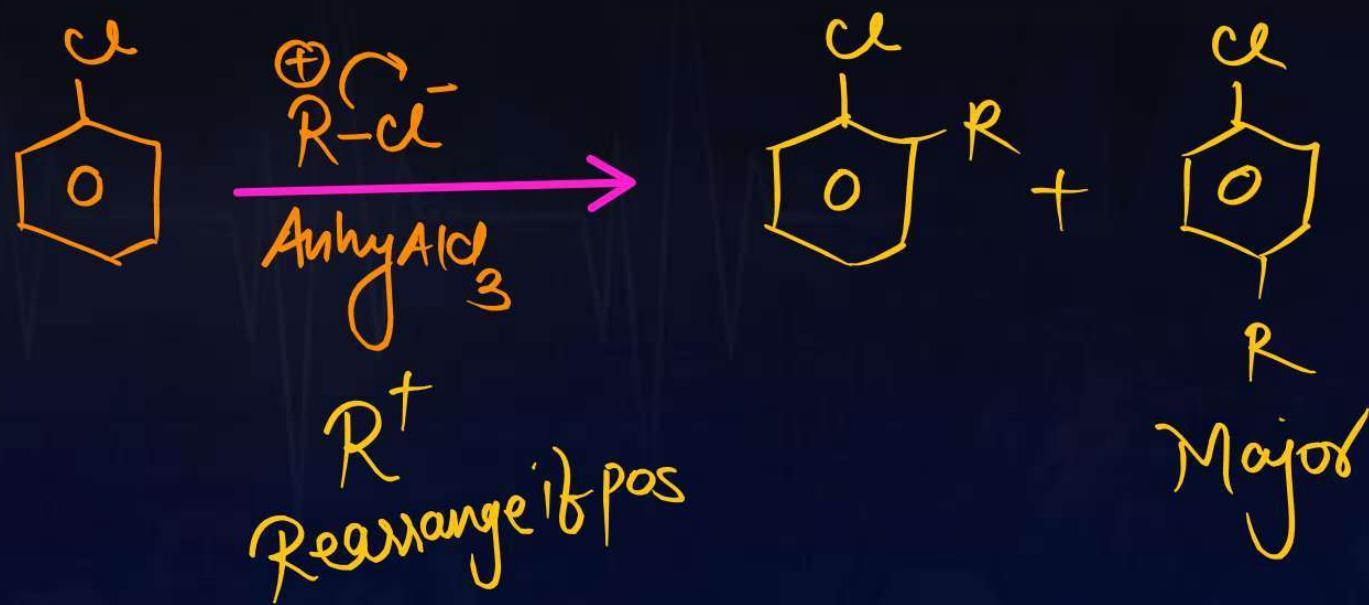


The sulphonation of chlorobenzene gives exclusively:

- A** An o-product
- C** An m-product

- B** An p-product
- D** An o-, p-disubstituted product

D. Friedel Craft Alkylation:



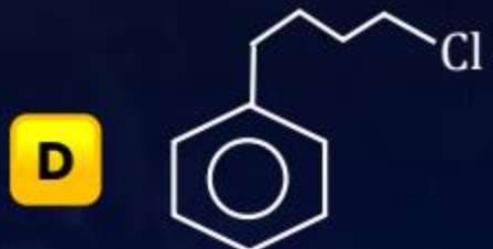
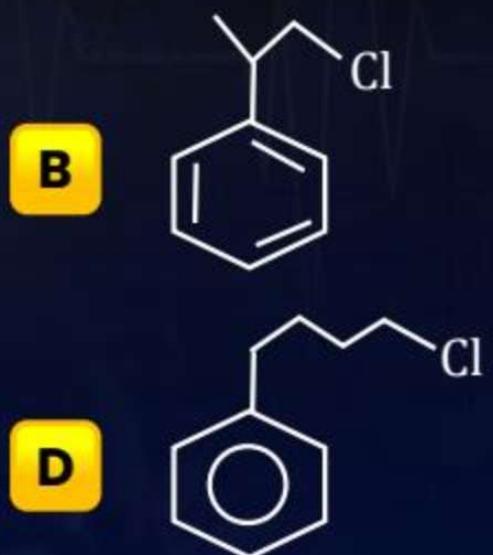
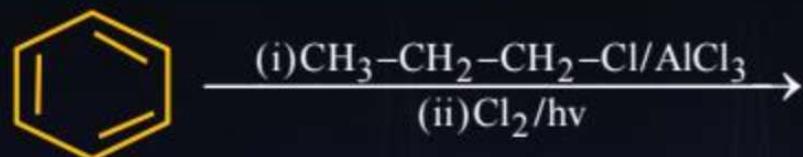
C.Q. 49 [AIPMT 2009]

Benzene reacts with CH_3Cl in the presence of anhydrous AlCl_3 to form:

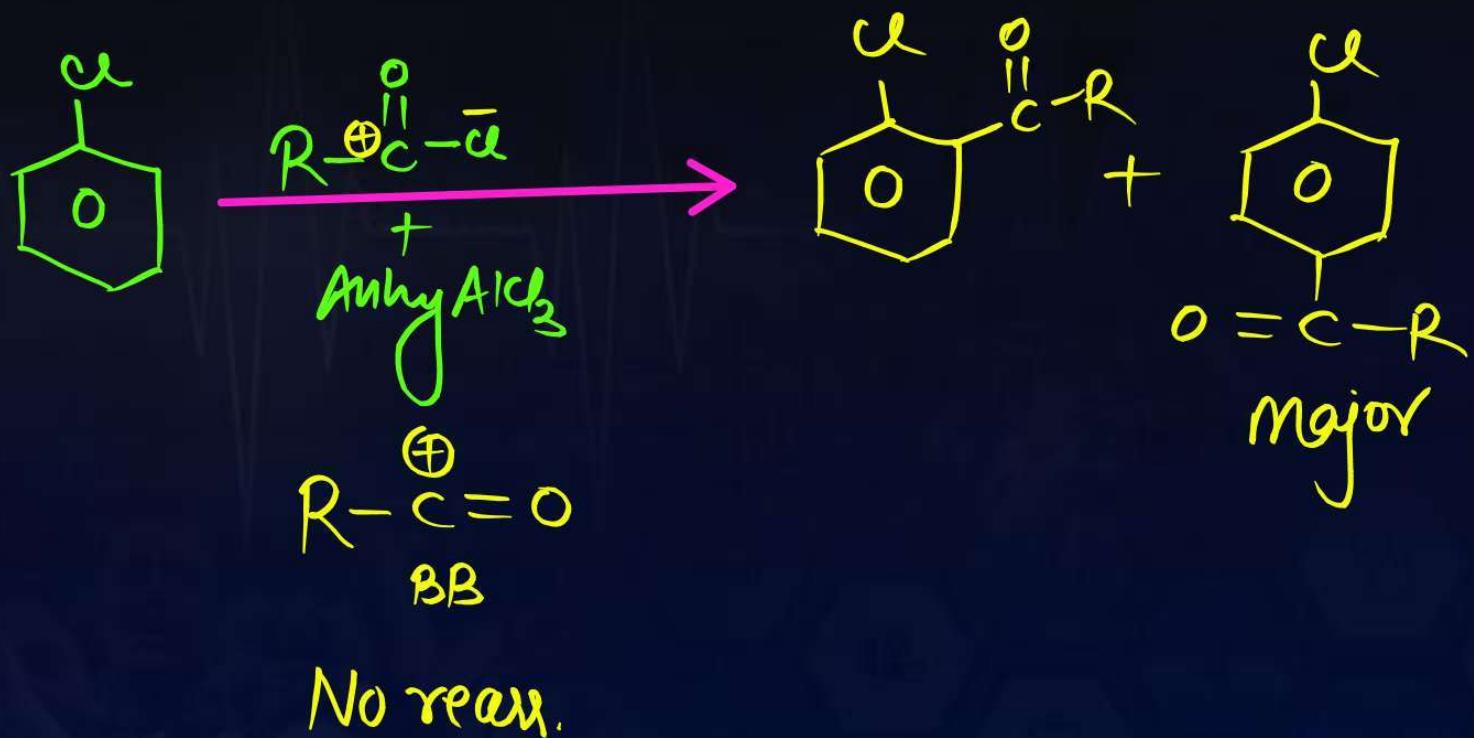
- A** chlorobenzene
- B** Benzyl chloride
- C** xylene
- D** toluene

C.Q. 50 (AIIMS 2018)

PW



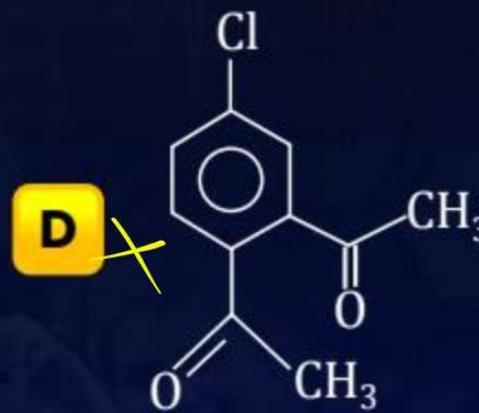
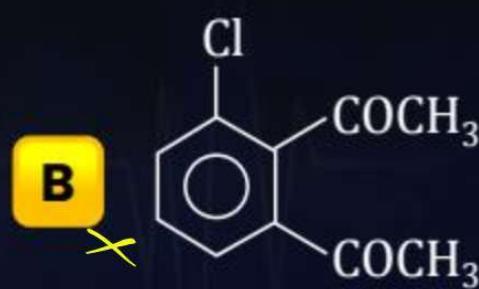
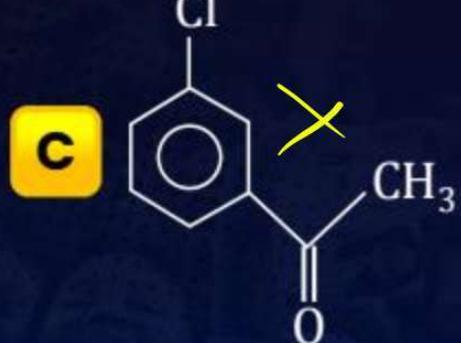
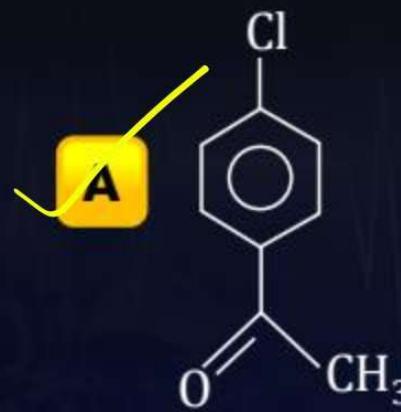
E. Friedel Craft Acylation:



C.Q. 51 [15 April, 2023 (Shift-I)]

PW

The major product formed in the Friedel-Crafts acylation of chlorobenzene is:





Reactions with Metals



A. Wurtz Reaction:



B. Wurtz-Fittig Reaction



C. Fittig Reaction



D. Ullmann Reaction



C.Q. 52 (JEE Mains 2025, 23 January Shift-1)

Match the List-I with List-II.

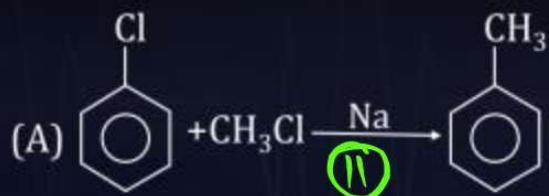
List-I (Name reaction)		List-II (Product obtainable)	
A.	Swarts reaction	I.	Ethyl benzene
B.	Sandmeyer's reaction	II.	Ethyl iodide
C.	Wurtz Fitting reaction	III.	Cyanobenzene
D.	Finkelstein reaction	IV.	Ethyl fluoride

Choose the correct answer from the options given below:

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

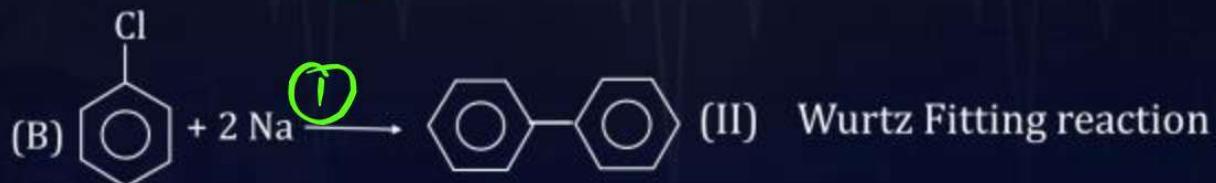
Match List-I with List-II

List -I

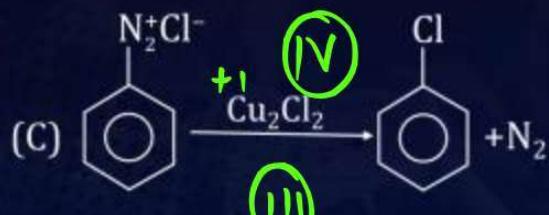


List -II

(I) Fitting reaction



(II) Wurtz Fitting reaction



(III) Finkelstein reaction



(IV) Sandmeyer reaction

Choose the correct answer from the option given below:

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



Grignard Reagent



MOP of Grignard Reagent:



OP Points:

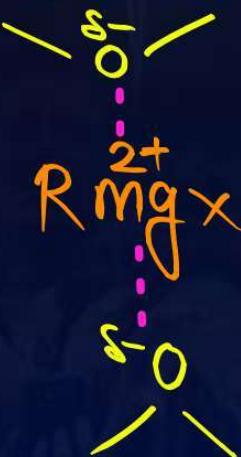
- ✓ 1. $\text{ROR} \cdots \rightarrow \text{R}-\text{F} < \text{R}-\text{Cl} < \text{R}-\text{Br} < \text{R}-\text{I}$
2. In moist condition, alkane will be formed.

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



3. Grignard Reagent is an Organometallic compound.
4. Dry ether stabilizes G.R & decreases the reactivity of G.R.

(metal & C bond is present)

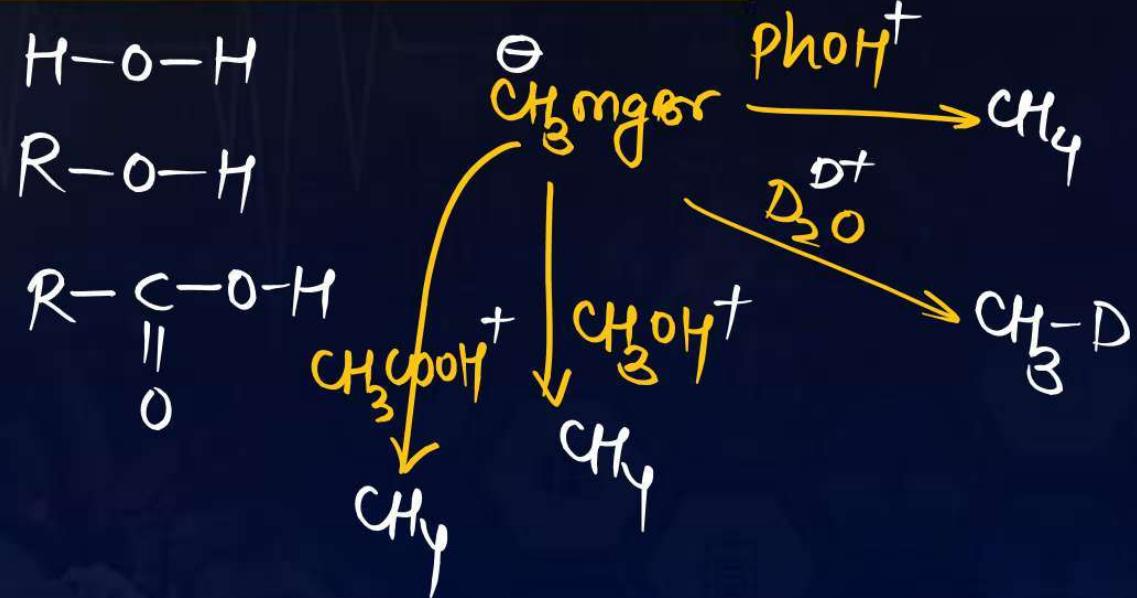
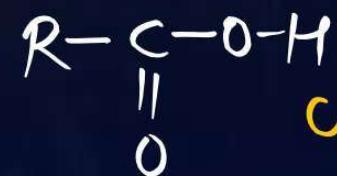
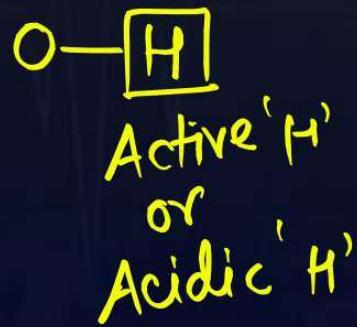




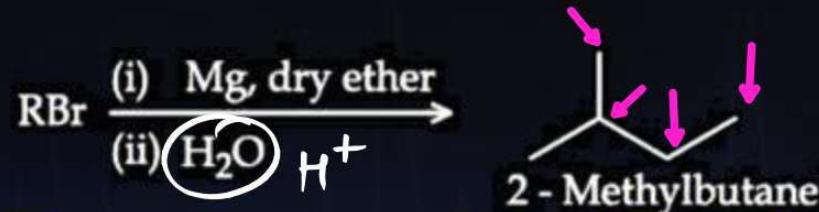
Chemical Reactions



1. Acid base reactions or Zerewitinoff's reactions:



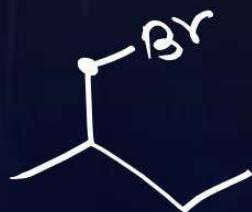
C.Q. 54 (JEE Mains 2025, 22 January Shift-2)



The maximum number of RBr producing 2-methylbutane by above sequence of reactions is (Consider the structural isomers only)

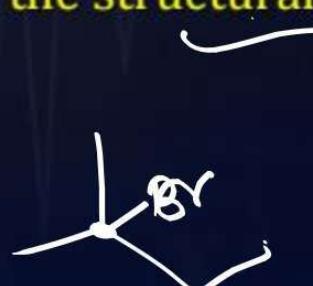
A

1



B

5



C

3



D

4

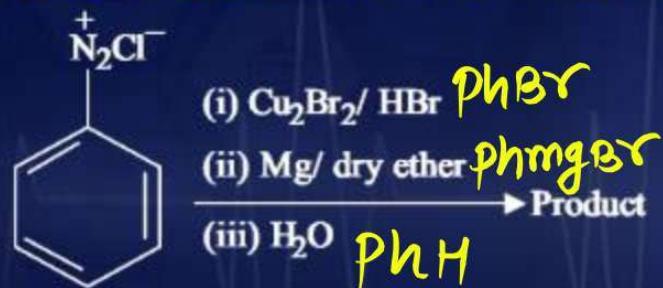


✓

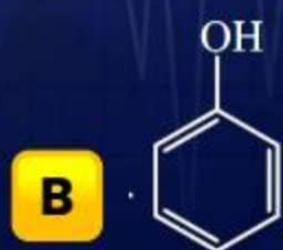
C.Q. 55 (NEET 2023)



Identify the product in the following reactions:



A



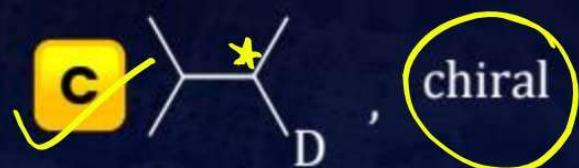
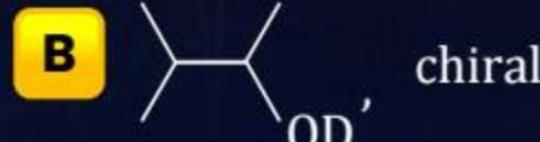
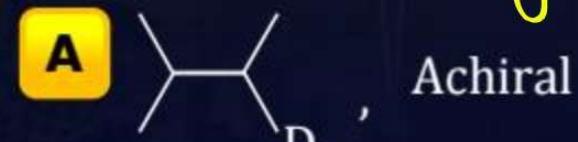
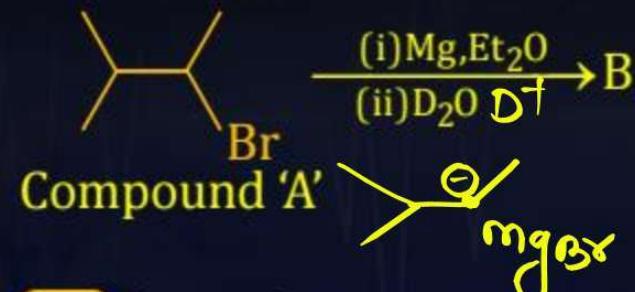
C



C.Q. 56 [29 July, 2022 (Shift-II)]



Compound 'A' undergoes following sequence of reactions to give compound 'B'. The correct structure and chirality of compound 'B' is: [where Et is $-C_2H_5$]





Polyhalogen Compounds

1. Dichloromethane:



Uses: Used as a solvent in paint removers, aerosols, metal cleaning and drug manufacturing.

Health Effects:

- Harms the central nervous system.
- Low exposure can cause slight hearing and vision impairment.
- High exposure leads to dizziness, nausea, tingling and numbness.
- Skin contact causes burning and redness.
- Eye contact can burn the cornea.

2. Trichloromethane (Chloroform):

Uses: Used as a solvent for fats, alkaloids, iodine, production of Freon refrigerant R-22, **anaesthetic** in surgery.

Health Effects:

- Central nervous system.
- Causes dizziness, fatigue, headaches and may damage the liver and kidneys.

Chemical Properties & Storage:

- Slowly oxidizes in air and light to form toxic carbonyl chloride (phosgene).
- Stored in sealed, dark-colored bottles to prevent oxidation.



3. Triiodomethane (Iodoform):

Uses: Used as an antiseptic but the antiseptic properties are due to the liberation of free iodine and not due to iodoform itself.



4. Tetrachloromethane (Carbon Tetrachloride): CCl_4

Uses: Used in the manufacture of refrigerants and aerosol propellants. Synthesis of chlorofluorocarbons (CFCs), pharmaceuticals. Used as a cleaning fluid, degreasing agent, spot remover and fire extinguisher.

Health Effects:

- Causes liver cancer in humans, eye irritation, irregular heartbeat or cardiac arrest.

Environmental Impact:

- Depletes the ozone layer which leads to increased exposure to ultraviolet (UV) rays, raising risks of skin cancer, eye diseases, and immune system disorders.

5. Freons:

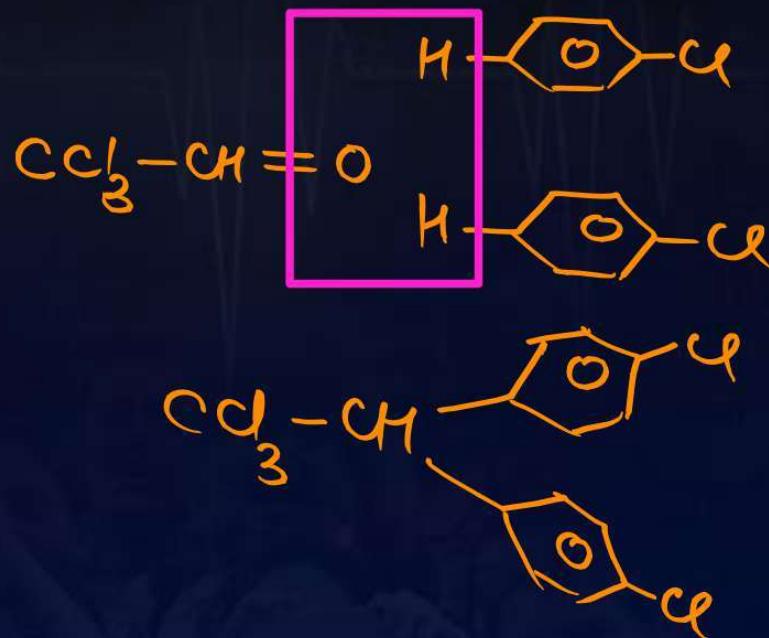


Uses: Used in aerosol propellants, refrigeration and air conditioning.

Environmental Impact: In the stratosphere, they initiate radical chain reactions, disrupting the natural ozone balance.

6. p,p'-dichloro diphenyl trichloro-ethane (DDT):

- DDT (Dichlorodiphenyltrichloroethane) was the first chlorinated organic insecticide.
- Used in mosquitoes (malaria) and lice (typhus).



Match List-I with List-II.

List-I

Compound

- (A) Carbon tetrachloride
- (B) Methylene chloride
- (C) DDT
- (D) Freons

List-II

Use

- (I) Paint remover
- (II) Refrigerators and air conditioners
- (III) Fire extinguisher
- (IV) Non-Biodegradable insecticide

Choose the correct answer from the options given below:

A

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

C

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



B

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

D

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

C.Q. 58 (JEE Mains 6th April 2024, Morning Shift)



Match List I with List II.

List-I (Compound)		List-II (Uses)	
A.	Iodoform 	I.	Fire extinguisher
B.	Carbon tetrachloride 	II.	Insecticide
C.	CFC 	III.	Antiseptic
D.	DDT 	IV.	Refrigerants

Choose the correct answer from the options given below:

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

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

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

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

In the following halogenated organic compound, the one with maximum number of chlorine atoms in its structure is:

- A Chloral CCl_3CHO
- B Gammamaxene $\text{C}_6\text{H}_6\text{Cl}_6$
- C Chloropicrin CCl_3NO_2
- D Freon-12 CF_2Cl_2

Which of the following is true about freons?

- A These are chlorofluorocarbon compounds. ✓
- B These are chemicals causing skin cancer. ✗
- C These are radicals of chlorine and chlorine monoxide. ✗
- D All radicals are called freons. ✗



Physical Properties of Haloalkanes & Haloarenes

1. Boiling Point

(BP & MW)



[O>P>m] [R-U < R-Br < R-I]

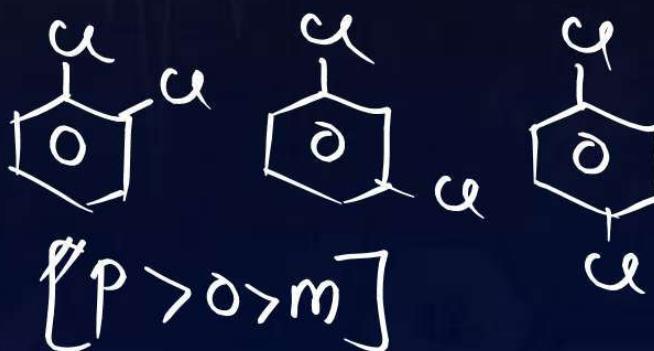
[BP & MW]

Alkyl Halide > Alkane
MW = same
polar

[(BP & 1 / Branch)]

2. Melting Point

\propto sym



[P > O > m]

3. Solubility

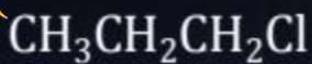
Haloalkanes partially soluble

C.Q. 61 (AIIMS 2006)



Which of the following compounds has the highest boiling point?

A



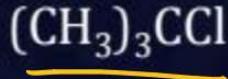
B



C

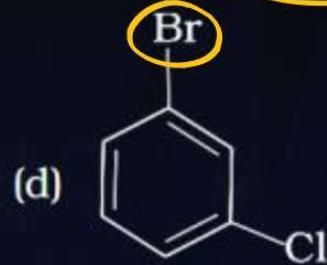
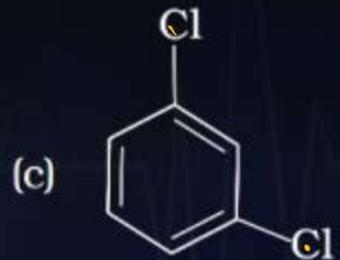
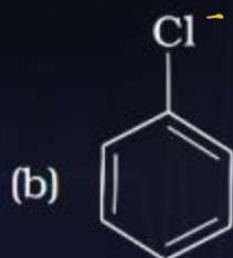
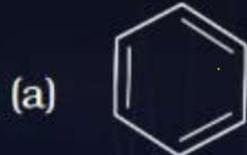


D



C.Q. 62 (NCERT Exemplar)

Arrange the following compounds in the increasing order of their densities. $\propto MW$



- A** (a) < (b) < (c) < (d)
- B** (a) < (c) < (d) < (b)
- C** (d) < (c) < (b) < (a)
- D** (b) < (d) < (c) < (a)

C.Q. 63 (NCERT Exemplar)



Which is the correct increasing order of boiling points of the following compounds?

1-Bromoethane, 1-Bromopropane, 1-Bromobutane, Bromobenzene

- A** Bromobenzene < 1-Bromobutane < 1-Bromopropane < 1-Bromoethane
- B** Bromobenzene < 1-Bromoethane < 1-Bromopropane < 1-Bromobutane
- C** 1-Bromopropane < 1-Bromobutane < 1-Bromoethane < Bromobenzene
- D** 1-Bromoethane < 1-Bromopropane < 1-Bromobutane < Bromobenzene



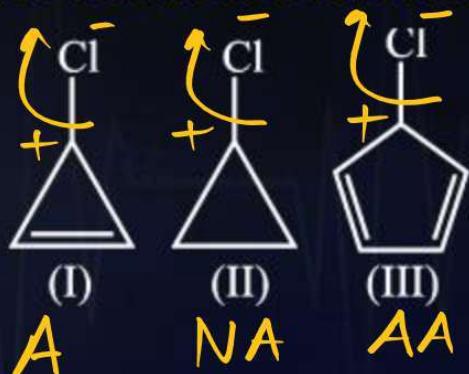


Practice Problems

QUESTION-1



For the following halides, order of rate of reaction with AgNO_3 or rate of S_N1 is:



\oplus

=

Lewis acid S_N1
Solvolytic

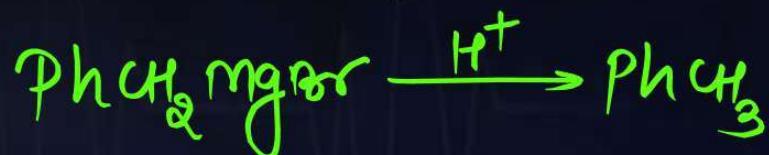
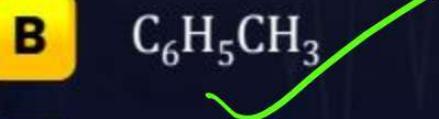
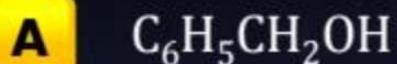
(BB > Am > M > H > I)

- A I > III > II
- B II > III > I
- C I > II > III
- D III > I > II

QUESTION-2



In the following reaction, $\text{C}_6\text{H}_5\text{CH}_2\text{Br} \xrightarrow[2. \text{H}_3\text{O}^+]{1. \text{Mg, Ether}} \text{X}$, the product 'X' is:



QUESTION-3



Given below are two statements:

Statement-I: Haloalkanes react with KCN to form alkyl cyanides as main product.

Statement-II: Haloalkanes react with AgCN to form alkyl isocyanides as the chief product.

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.

QUESTION-4



In the following pairs of halogen compounds, which would undergo S_N2 reaction faster?



- A B
- C D

QUESTION-5



Among the given statements:

1. Haloalkanes are very slightly soluble in water. ✓
2. A mixture of an alkyl halide and aryl halide gives an alkyl arene when treated with sodium in dry ether and is called Wurtz-Fittig reaction. ✓
3. Aryl halides are extremely less reactive towards nucleophilic substitution reactions. ✓

The correct statement is/are:

- A** 1, 2 and 3
- B** 1 only
- C** 3 only
- D** 2 only

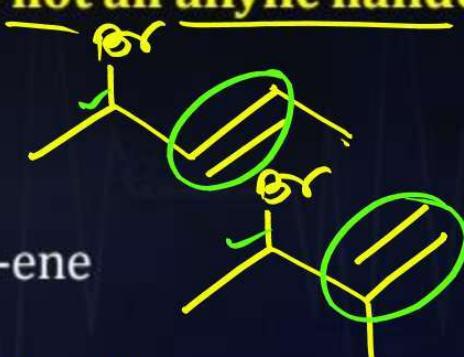
A hand-drawn yellow curved arrow originates from the bottom of the letter "A" in the first option and points towards the top of the letter "1" in the same option.

QUESTION-6



Which one of the following is not an allylic halide?

A 4-Bromopent-2-ene



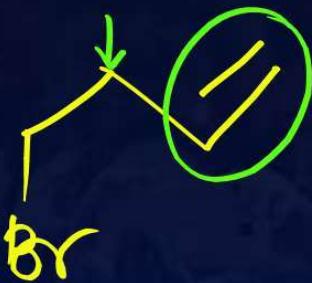
B 3-Bromo-2-methylbut-1-ene



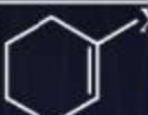
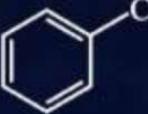
C 1-Bromobut-2-ene



D 4-Bromobut-1-ene



QUESTION-7**Match List I with List II**

	List I		List II
(A)	 III	(I)	Tertiary alkyl halide
(B)	$\begin{array}{c} R' \\ \\ R'' - C - X \\ \\ R''' \end{array}$ I	(II)	Aryl halide
(C)	 IV	(III)	Vinylic halide
(D)	 II	(IV)	Benzyllic halide

Choose the correct answer from the options given below:

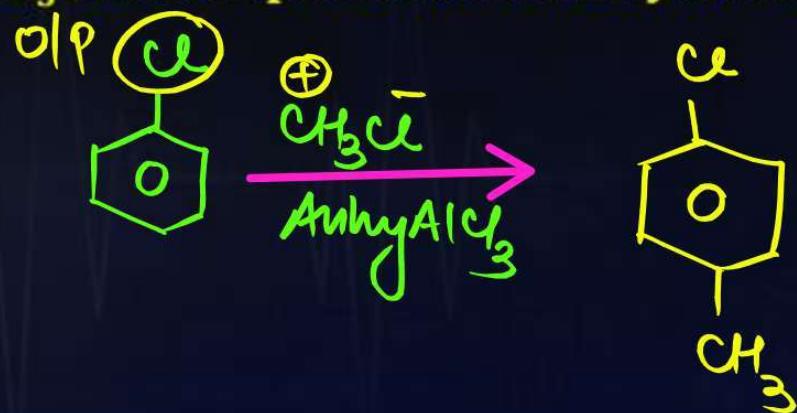
- A A-III, B-I, C-IV, D-II
- B A-III, B-II, C-IV, D-I
- C A-II, B-I, C-III, D-IV
- D A-II, B-III, C-IV, D-I

QUESTION-8



Chlorobenzene reacts with CH_3Cl in the presence of anhydrous AlCl_3 to form:

- A benzene
- B Benzyl chloride
- C xylene
- D 1-Chloro-4-methylbenzene



QUESTION-9



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

Assertion (A): Rate of reaction is dependent only on the concentration of nucleophile in S_N1 reactions.

Reason (R): Polar solvent favours S_N1 reactions.

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-10

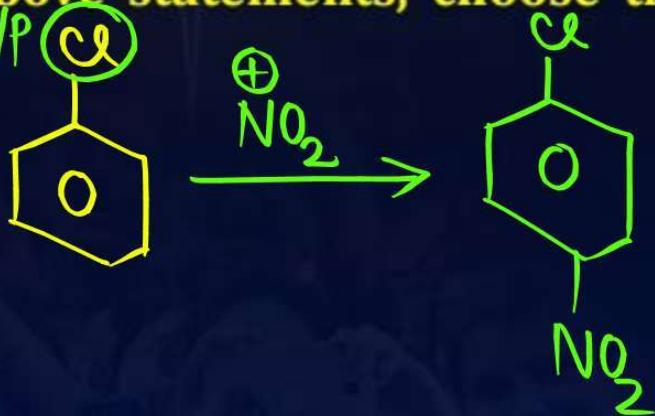


Given below are two statements:

Statement-I: Nitration of chlorobenzene forms 1-chloro-4-nitrobenzene as the major product.

Statement-II: Chlorine is an electron withdrawing group and directs electrophiles to meta position in electrophilic aromatic substitution reactions.

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

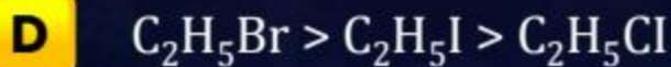
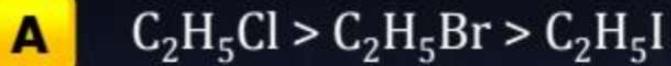


- A Statement I is correct but Statement II is incorrect.
- B Statement I is incorrect but Statement II is correct.
- C Both Statement I and Statement II are correct.
- D Both Statement I and Statement II are incorrect.

QUESTION-11



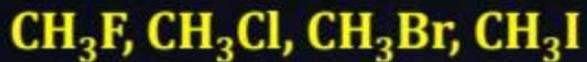
Correct order of boiling points for the given alkyl halides is:



QUESTION-12

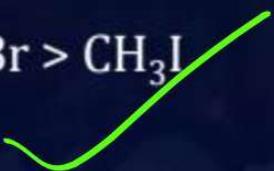


Correct dipole moment order of the following compounds is:



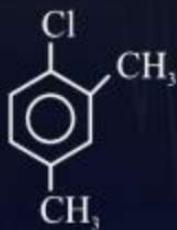
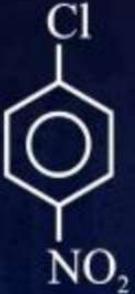
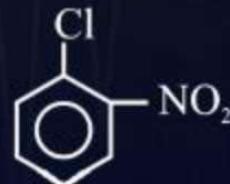
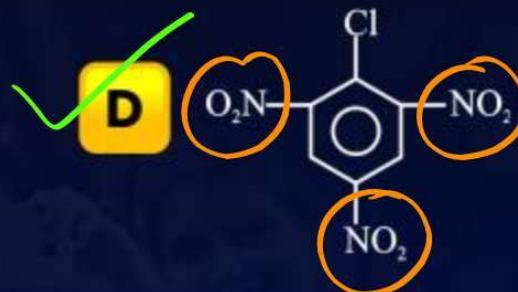
$$\text{C}-\text{Cl} > \text{C}-\text{F}$$
$$(\text{q} \times \text{d}) > (\text{q} \times \text{d})$$

- A $\text{CH}_3\text{F} > \text{CH}_3\text{Cl} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$
- B $\text{CH}_3\text{F} < \text{CH}_3\text{Cl} < \text{CH}_3\text{Br} < \text{CH}_3\text{I}$
- C $\text{CH}_3\text{F} > \text{CH}_3\text{Cl} > \text{CH}_3\text{I} > \text{CH}_3\text{Br}$
- D $\text{CH}_3\text{Cl} > \text{CH}_3\text{F} > \text{CH}_3\text{Br} > \text{CH}_3\text{I}$



QUESTION-13

Which of the following compound undergoes replacement of -Cl by -OH group by merely warming the compound with aqueous NaOH?

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

Most Reactive

$\text{No. of } \text{NO}_2 \uparrow$ $\text{ROR} \uparrow$

QUESTION-14

The synthesis of methyl fluoride by heating methyl chloride in the presence of AgF is known as:

- A Fittig reaction
- B Sandmeyer's reaction
- C Swarts reaction
- D Finkelstein reaction



QUESTION-15



Consider the following bromides:



The correct order of S_N1 reaction is:

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

formation of 1^{st} C^+ check stability

QUESTION-16

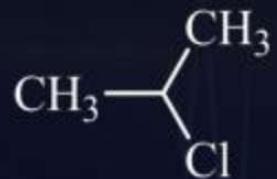
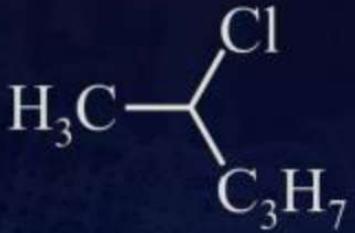
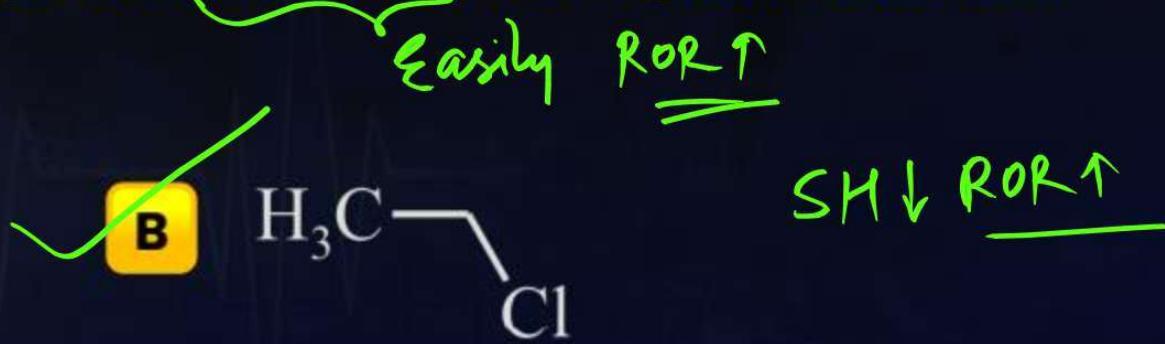
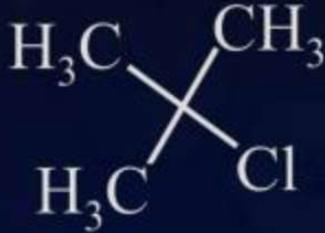


The given reaction is an example of; $\text{C}_2\text{H}_5\text{Br} + \text{KCN(aq)} \rightarrow \text{C}_2\text{H}_5\text{CN} + \text{KBr}$
 S_N^2

- A Elimination reaction
- B Nucleophilic substitution
- C Electrophilic substitution
- D Redox change

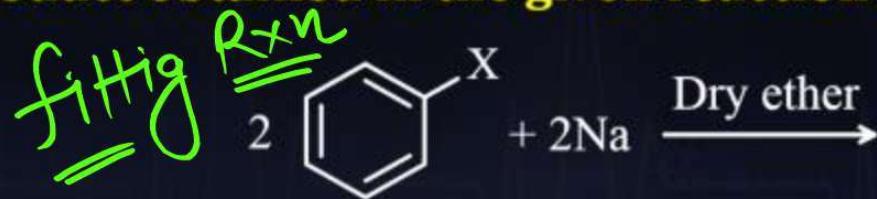
QUESTION-17

Which one of the following compound most readily undergoes substitution by S_N2 mechanism?

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

QUESTION-18

The product obtained in the given reaction is:



A



B



C



D

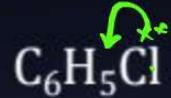


QUESTION-19

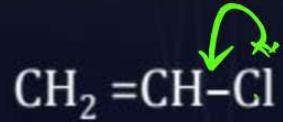


Which one of the following is the most reactive towards nucleophilic substitution reactions?

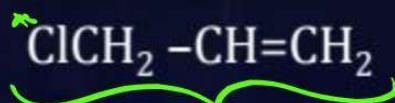
A



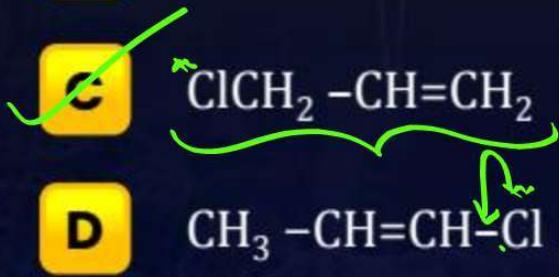
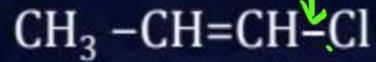
B



C

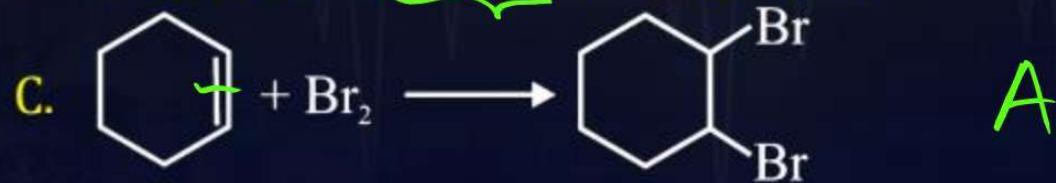
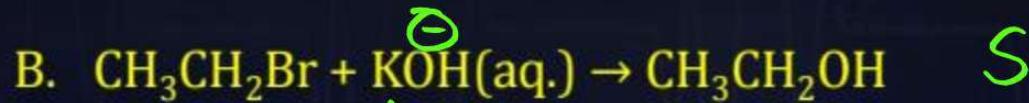


D



QUESTION-20

Which of the following statements is correct for the given reactions?



- A** (A) and (B) are elimination reactions and (C) is an addition reaction.
- B** (A) is elimination, (B) is substitution and (C) is addition reaction.
- C** (A) is elimination, (B) and (C) are substitution reactions.
- D** (A) is substitution, (B) and (C) are addition reactions.

JEE main 4-Apr 5-2

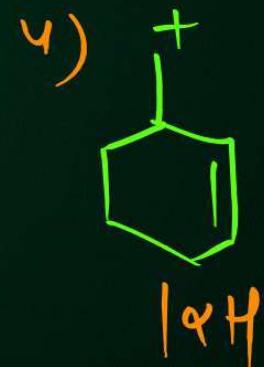
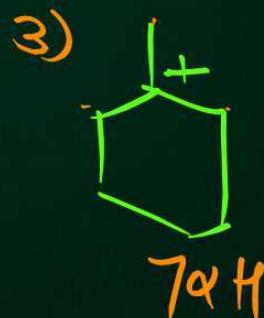
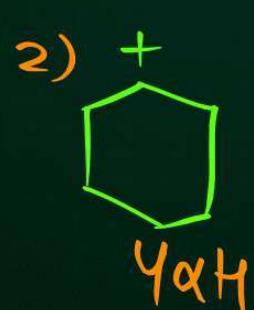
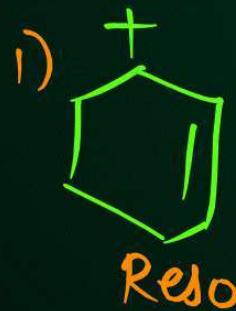
Q1

S-1 ~~X~~ Alcohol is prep from alkyl Halide in presence of aq KOH
by Elimination

S-2 ✓ Alkene is prep from alkyl halide with alc KOH by
 β -eli

Q2

Compare stability



$1 > 3 > 2 > 4$

Q3

